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THE AMERICAN GAS-LIGHT JOURNAL AND CHEMICAL REPERTORY

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☞ An asterisk (*) denotes an illustrated article

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LONDON TREATISE ON THE MANUFACTURE AND DISTRIBUTION OF COAL GAS.

We are informed that the above work will be completed in *about* twenty four numbers and extend through about two years. No one in the business should be without it. To those who have not ordered it we would suggest that they send, at once, names and address. The first three numbers have been forwarded to those who ordered them early. To others the back numbers will be sent, and the work will come regularly every month. Price forty cents a number. Bills will be sent in due time.

YIELDS.

The following table may be of use to some engineers in calculating their workings. It is true that it is a simple matter to divide the yield in feet per ton by 2240, but it is just as simple to have it in tabulated form, in a memorandum book, which one always has with him—

9500	feet per ton	gives 4.241	per lb.
9600	"	" 4.286	"
9700	"	" 4.330	"
9800	"	" 4.375	"
9900	"	" 4.419	"
10000	"	" 4.464	"
10100	"	" 4.509	"
10200	"	" 4.553	"
10300	"	" 4.598	"
10400	"	" 4.642	"
10500	"	" 4.687	"
10600	"	" 4.732	"
10700	"	" 4.776	"
10800	"	" 4.821	"
10900	"	" 4.865	"
11000	"	" 4.910	"
11100	"	" 4.955	"
11200	"	" 4.999	"
11300	"	" 5.044	"
11400	"	" 5.088	"
11500	"	" 5.133	"
11600	"	" 5.178	"
11700	"	" 5.222	"
11800	"	" 5.267	"
11900	"	" 5.311	"
12000	"	" 5.356	"
12100	"	" 5.401	"
12200	"	" 5.445	"
12300	"	" 5.490	"
12400	"	" 5.534	"
12500	"	" 5.579	"

The table, as will be seen from inspection, is calculated for each hundred feet of yield per ton from 9,500 to 12,500. These limits we deem ample, as no one ought to get a yield of less than 9,500 feet, and we do not think that many gas managers succeed in getting much over 12,500 feet from coal, in regular everyday working. In the issue of Dec. 2d, 1876, we gave the results of some estimates, as to the value of enrichers, derived by the use of the candle-feet formulars. The candle-feet (product of illuminating power, in candles, by yield in feet per lb.) method is extremely simple and useful in comparing the results of different workings. Suppose, for instance, in using one coal, or mixture of coals, we get 4·68 feet per lb., of 17 candle gas, and with another we get 5·10 cubic feet, of 15 candle gas. From which do we get the most light?—*i. e.*, the most candle power and yield combined; by throwing the result of each working into candle feet we can compare them at a glance—

The 1st gives us 79·56 candle feet.
The 2d " " 76·50 "

showing that the first gives us the most. In the same way two men in comparing their results often find it difficult to make up their minds which is doing better than the other, one claiming that he makes the larger yield, while the other, admitting this, claims the palm from the fact that his gas is so much higher in illuminating power that it more than compensates for the smaller yield. The only way to get at the matter is to multiply the yield by the candle power and the product is the candle feet of the working, and they have only two numbers to compare instead of four, and they will express the relative values of the amount of light obtained.

Take another case—one man finds the result of his working, say, for a month, to be 5·25 feet to the pound, of 15 candle gas; another finds his result to be 4·375 feet to the pound, of 18 candle gas—which has obtained the most light? Evidently, they are both the same, for they each give 78·75 candle feet. So that, as far as the product of the material used is concerned, the result in each case is the same. When the question of profit comes in then the cost of the different mixtures must be estimated, and the price at which the gas is sold must be considered. If they each get the same price per thousand for their gas then the one making the 5.25 ft. to the lb. is getting the best financial results, unaccounted-for-gas being left out of the account.

In obtaining these identical *candle-feet* results, the mixtures of coal and enricher may have been the same in each case, making cost of material used equal in the two. The difference in the illuminating power of the two gases being the result of different heats, or of a difference in the way in which the exhauster was used, or both combined. We would suggest to engineers to rule a small column in their books of daily make, etc., and carry out in this space the *candle-feet* of each day's working, and, in this way, they can see exactly the value of their results.

Experiments Made at Works of Boston Gas-Light Company, 1876 and 1877, by Malcolm S. Greenough, Esq.

Date.	Weight of each charge in pounds.	Temperature at 9 30 A. M., deg. F.	Quantity of gas in 1st. 4 hours.	Amount of gas per pound of coal.	T° at 1 30 P. M.	Quantity, 2d four hours.	Quantity per pound of coal.	T° at 5 30 P. M.	Quantity, 3d four hours.	Quantity per pound of coal.	T° at 9 30 P. M.	Quantity, 4th four hours.	Quantity per pound of coal.	T° at 1 30 A. M.	Quantity, 5th four hours.	Quantity per pound of coal.	T° at 5 30 A. M.	Quantity, 6th four hours.	Quantity per pound of coal.	T° at 9 30 A. M.	Whole amount of gas made.	Quantity per pound of coal.	Quantity coke used in bushels.	Quantity of coke used, in bushels.	Per cent. of coke used.	Average temperature.
1877																											
January 16 and 17	2500	2133	12700	5.08	2132	13300	5.32	2197	12370	4.96	2102	12540	5.02	2166	12890	5.16	2208	12440	4.98	2166	76240	5.08	285½	134	.47	2158
" 18 " 19	2500	2270	12320	4.93	2132	12630	5.05	2197	12480	5.00	2101	12890	5.15	2168	13380	5.35	2199	13160	5.26	2197	76860	5.12	290	136	.45	2180
" 24 " 25	2500	2134	12550	5.02	2197	13140	5.25	2260	11910	4.76	1939	12750	5.10	2070	12750	5.10	2134	12230	4.89	2200	75330	5.02	278	126	.45	2133
February 5 and 6	2500	2235	12800	5.12	2235	12720	5.09	2198	12550	5.02	2102	13140	5.25	2198	13370	5.35	2235	12720	5.09	2198	77300	5.15	260	134	.51	2200
" 16 " 17	2600	2236	13250	5.09	2234	13250	5.09	2234	12990	4.99	2166	13210	5.08	2198	13620	5.24	2198	12730	4.89	2198	79050	5.06	299	134	.41	2209
" 19 " 20	2400	2294	12610	5.25	2263	12530	5.22	2200	11860	4.90	2165	12620	5.25	2262	13130	5.47	2325	12290	5.12	2294	75040	5.21	253	130	.51	2257

These retorts are 21" × 12" × 8'3" inside. They are run with ¾" seal on dip-pipe, and a slight vacuum on main, leaving small pressure on retort. They have been running about 17 months. These experiments were all made with dry Penn coal.

Date.	Weight of charge.	Temperature at start.	Temperature after 1 hour.	Temperature after 2 hours.	Temperature after 3 hours.	Temperature after 4 hours.
1876						
Nov. 23....	200	2289	1403	1660	2113	2210
Nov. 25....	200	2239	1400	1788	2143	2239
Dec. 21....	208	2271	1271	1432	1852	2175

$$T = \frac{W\,(O - t^{\circ})}{wx} + O$$

T = temperature of Retort.
W = weight of water before immersion.
O = temperature of water after immersion.
t = " " " before "
w = weight of Iron.
x = specific heat of iron = ·126.

TEMPERATURE OF RETORTS.

In our last we referred to an extensive set of experiments, made by Mr. Malcolm S. Greenough, at the works of the Boston Gas-Light Company, for the purpose of determining the actual temperature of retorts, the yield corresponding to different heats, and the amount of coke used to produce them.

These experiments were made with two benches, of six retorts each, running in the middle of a working range, but having an independent hydraulic main connected with a complete experimental apparatus large enough to make the working a practical one. In fact, this experimental works is a complete plant by itself, having 6-inch connections throughout. The method pursued in determining these temperatures is about as follows:

First. A series of tests were made to determine the average heat of the bench, and it was found that the heat of the middle retorts gave a fair average of the temperatures of all the retorts in the bench, so that the final experiments to determine the heats of the bench were made with the middle retorts.

The method of determining the temperature was by calculating it from the following formula, and depends upon the principle that knowing the specific heat of any substance the temperature to which it is subjected may be determined.

By taking some metal of known weight, whose specific heat is also known, as, for instance, iron, and subjecting it for sufficient time to the heat of the retort, and then withdrawing it therefrom and plunging it into a body of water, the weight of which is known, and carefully noting the temperature of the water before and after immersion, we have all the values for unknown quantities necessary for solving the equation expressing the relations already determined as existing between the temperature and specific heat of the iron, and the weights of water and iron. The equation used was the following—

$$T = \frac{W\,(O - t)}{wx} + O$$

in which—

T = temperature of retort.
W = weight of water before immersion.
O = temperature of water after immersion
t = " " " before "
w = weight of iron.
x = specific heat of iron.

The values given by different authorities for the specific heat of iron vary from .117 upwards, the value assumed in these experiments was .126.

The weight of iron used was 5 lbs. A large can of water, holding a sufficient quantity for the purpose, which was carefully weighed, giving the value W, was placed near at hand, and the temperature taken just before immersion for the value of O. The iron, with a rod attached, for the purpose of removing it, is placed as near as possible in the centre of the charge of coal. When the time arrives the lid is removed, the iron withdrawn and quickly plunged in the water; the temperature of the water is carefully watched by a thermometer, and the readings taken at short intervals. The temperature will be found to rise rapidly for a time, and then it will begin to fall again. The highest reading is taken for the value of t, Having thus all the unknown quantities the equation is solved, and the result of the test determined.

The Table given elsewhere shows the result of several experiments made by this method; and, we believe, this is the first time that any table of this kind has been published in English.

The practical value of the table is one of comparison, and, as was stated by Mr. Greenough at the time it was submitted at the last meeting of the New England Association of Gas Engineers, it is sincerely to be hoped that other tests will be made by other engineers, using the same basis of calculation, for the purpose of comparing results. The settings used by him are medium, being neither very heavy nor very light. If some one having either very heavy or very light settings would try this experiment, there might be some important light obtained upon the value, as to consumption of fuel, of various styles setting.

The Science of gas-making has been benefitted by the valuable information conveyed by Mr. Greenough in his careful experiments.

French Practice in the Construction of Gas Holders.

By M. Arson, Engineer-in-Chief of the Paris Gas Company.

[Translated for the London *Journal of Gas-Lighting*, by Dr. W. Pole, F. R. S., Mem. Inst. C. E.]

Inlet and Outlet Pipes.

The gasholder is connected with the gas-making establishment by an inlet-pipe, and with the town distribution by an outlet-pipe, both pipes being furnished with valves. These pipes should have diameters suitable for the capacity of the gasholder, and they ought to be properly protected against any accidents which might interrupt their action.

These conditions, simple as they appear, are attended with difficulties that give great interest to the diverse solutions they have received.

Size of the Pipes.—The inlet conduits ought to have sufficient area not to cause undue resistance to the passage of the gas, and so to diminish the available pressure. They ought also to be capable of being interchanged (*i. e.*, the inlet-pipe used as an outlet, and *vice versa*), and each, therefore, ought to be of such size as to serve for either purpose. And further, their diameters and forms should be such as to allow fully for the obstructions frequently caused by the deposit of naphthaline; and it is desirable to provide means of access for extracting these deposits without suspending the action of the gasholder.

For the fulfillment of these conditions it is desirable to give the pipes a diameter corresponding to a maximum velocity of 5 metres (16½ fee

per second. If this size renders them inconveniently large, they can be increased in number, This rule has been followed for the holder No 18, at La Villette, with perfect satisfaction.

Form of the Pipes.—Two systems are adopted in this respect—1. Fixed pipes in the form of inverted syphons, which descend to the level of the bottom of the tank, pass underneath the walls, and rise inside it to above the water level. 2. Jointed pipes which rise above the ground. and enter the bell by the crown. These pipes, which have to follow the movements of the bell, must, of course, be jointed in three points of their length.

Each of these systems must satisfy conditions which it is desirable to examine.

Fixed Pipes. —The fixed arrangement consists of a vertical pipe outside, which descends in a well, where it is accessible ; then there is a horizontal part, and finally a vertical branch contained in the tank, the two latter portions being inaccessible. The elbow at the bottom of the well is the furthest point to which direct access can be obtained, and it is necessary to ensure this access by making the well perfectly tight against infiltrations of water from the tank, or from the soil. The top end of the pipe, inside the bell, also forms a means of access, but its use is very restricted, unless the manhole over it is removed, when the gasholder must, of course, be thrown out of use.

Two causes of obstruction in the pipes are to be feared—namely, the infiltration of water by a leaky joint, and the crystallization of naphthaline under the influence of cold.

To diminish the risk of the first, the horizontal pipe ought to be formed in a single piece, so as avoid a joint, which is inaccessible, and in all cases difficult to make.

In order not to offer to the naphthaline a place of deposit where it may crystallize at rest, it is desirable not to have any sudden enlargement of section at the base of the vertical pipe inside the tank. An elbow, cast with a foundation-plate, which will spread the weight of the pipe over a large surface of masonry, satisfies this condition. The horizontal pipe, inclined as much as possible, and cast in one piece, connects the elbow with the base of the external vertical pipe in the well, and carries the condensed liquids there.

It is customary to place at this latter point a large cast-iron piece, destined to receive the products of condensation ; this is of little utility, and is very cumbrous. A T-piece, giving free access to the horizontal pipe, is certainly preferable. In any case, a syphon and a pump ought to be attached to the pipe, the lower part of which, being always cold, condenses the last traces of moisture carried in the gas.

The naphthaline, which the gas always contains, and the crystallization of which arises under influences at present very obscure (cooling or drying, for example), often produces in the pipes obstructions which much reduce the area, or even stop it entirely. These crystallizations, in flakes extremely thin, are easy to remove by copious washing with cold water. The water may be introduced by the interior pipe, either by uncovering the manhole over it, or by using a syphon, which gives access to the water without emptying the gasholder ; and by this means the naphthaline may be driven to the bottom of the exterior vertical pipe, where it may be pumped out. The ordinary syphon pump used for extracting the condensed liquid is not sufficient for this purpose ; recourse must be had to a more powerful pump, specially adapted to the purpose. Letestu's pump is suitable, and preparations should be made for its application whenever necessary.

Articulated Pipes.—This system was used for the first time in the construction of the gasholder at Ivry, belonging then to Messrs. Pauwels and Du Bochet ; it was designed in order to overcome the difficulties attending the access to these gasholders, the bottom of which was 25 metres below the surface, and drowned in water. Its application proved so satisfactory that it has since been applied to ordinary gasholders.

The apparatus is formed of straight pipes of sheet iron, tolerably light, connected by joints in cast iron. Each joint consists of a pipe at right angles to the direction of the main-pipe, the two extremities turning in stuffing boxes. The stuffing of these joints presents no difficulty during the movement of the gasholder, and requires only ordinary care. Yarn (*de l'etoupe*) soaked in melted suet, or even in oil, suffices to ensure the tightness of the joint during the action of the bell.

Naphthaline has not yet appeared in these pipes, although they have been in action more than thirty years at Ivry, and a long time elsewhere.

Gasholder No. 13, at La Villette, offers a very interesting example of the application of the system, as it has dispensed with the construction of four wells, which would have been much more costly.

(On a late visit to the Paris Gas-Works, I had an opportunity of seeing these articulated pipes at work on several gasholders to which they are attached. They appear to act very well; they are said to give no trouble, and to require only moderate attention to keep them in order. The authorities are so convinced of their advantages that they are now applying them to all new gasholders erected.—Trans.]

VI.—Guides.

The stability of the bell of a gasholder constitutes a problem as difficult to realize as it is important to resolve.

The center of gravity of the bell is much above its center of figure; it is in a state of instable equilibrium, and it tends to topple over as soon as the two centers cease to be maintained in the same vertical line.

The equilibrium during the rise and fall is not the only condition to be satisfied in order to ensure the stability; the apparatus ought to resist to the most perfect extent the disturbing action of all external causes—the wind, for example, which may exercise on the bell of a gasholder a very powerful force, against which it must be efficiently protected. This result may indeed be attained by the construction of a building surrounding the gasholder when its dimensions are small; but for the sizes required by large companies this is impossible, and the stability must be ensured by other means, even against the most furious winds.

It is not only the wind which menaces the stability of gasholders ; there is another cause often more serious—namely, the accidental stoppage of one point of the bell; for if this takes place, the motion which tends to continue in the other parts may give rise to horizontal pressure of great magnitude.

Estimate of the Action of the Wind.—It is found, by special tables, that the wind in great hurricanes may attain a velocity of 45·30 meters (150 feet) per second, and may exercise on a plane surface, which it strikes perpendicularly, a pressure of 277·87 kilogrammes per square metre (50 lbs. per square foot.)

The cylindrical form of the bell of a gasholder has certainly the effect of diminishing this action n a great degree, but writers do not give any direct measure of the reduction, at least so far as concerns the wind,

For water, it is generally considered that the pressure exerted by a current of water acting against a right prism, preceded by a semi-cylindrical surface, is reduced in the proportion of 1·10 to 0·57. The form of the back part of piers has also been studied from the same point of view ; and when this part is formed by two planes inclined at 45°, it reduces the pressure further by 11 per cent. The total force may, therefore, be considered to be reduced in a cylinder to 0·46 of what it is on a plane.

If these data are applicable to aeriform fluids, we should be justified in estimating that the force of the wind per square metre of the upwright section of the bell of a gasholder would be reduced to

277·87 kilogrammes × 0·46=127·82

i. e., 26 lbs. per square foot.

[The author's data are, no doubt, taken from Smeaton's well-known table. The editor had occasion, a short time ago, to make inquiries with a view to determine what would be the greatest pressure of wind likely to act sideways on an engineering structure, and for this purpose he was favored by the Astronomer-Royal with some very valuable data from the records of the Greenwich Observatory. The result of the inquiry was that, although the pressure of the wind does sometimes amount to 40 lbs. per square foot, yet that this is only upon very limited surfaces, and for very limited times. Over a large surface a much more moderate estimate will suffice.

As to the reduction for the shape, Professor Rankine estimates the effective pressure against a rounded surface, like a circular chimney, at half what it would be against a flat surface of equal sectional area.

[No doubt, therefore, the rule in the text is on the safe side.—Trans.]

Distribution of the Pressure on the Rollers.—The total pressure of the wind will be distributed on four rollers—two in the tank, and two acting on the guides. Hence, if D be the diameter and H the height of the bell, in feet (supposed all above the tank), the horizontal force with which each roller will be pressed against the guide will be—

$$F = \frac{26\ DH}{4} \text{ in pounds.}$$

[The author goes on with a mathematical investigation of the strength of the column-guides and framing to resist the pressures which may come upon them. He takes several cases ; first, a system of guides formed of four columns, with accessory bracing ; next, a similar system of six columns ; and then a system of eight or more ; after which he shows an application of the calculations to one of the gasholders at La Villette. The calculations are complicated and elaborate and their general applicability appears to me doubtful. There is such great variety in the construction of gasholder guides and framing, as designed by different engineers for different circumstances, that no general formulæ could be universally applicable; each case must be studied according to its own design, and for this purpose the ordinary principles of mechanics, as applied to the strength of structures in iron, will serve. If it is desired to follow ont the mode of investigation adopted by the author, the orginal can be referred to.—Trans.]

* * * * * * *

VII.

Scaffolding for the Construction and Support of the Bell.

The framing of carpentry serves several purposes. It was used during the construction of the cylinder of the bell ; it was necessary for the construction of the crown, and it will serve during the use of the gasholder as a support to the crown, to prevent its deformation at any time when the pressure is removed.

These three conditions determine the design and dimensions of this part of the work.

The first necessity is that the external parts of the framing should approach so near to the cylindrical sides of the bell, that the workmen may be supported by them in fixing the sheets This may be done easily by means of suspended platforms, the chains of which are shortened in proportion as the work rises higher.

The second condition requires that all the horizontal surface of the tank shall be provided with vertical piles equally distributed, offering a sufficient number of points to support the weight of the floor of planking and of the crown of the gasholder. The planking destined to support the workmen ought to be stronger than is usually thought necessary. It happens that during the construction the spherical plaiting of the crown requires to be stretched; the workmen, to do this, raise the plaiting by means of the stays resting on the planking, and which exert considerable pressure thereon.

To fulfil the third condition, the part of the scaffolding which will serve to form supports, uniformily distributed, should be left permanently standing. The vertical piles, which have been laid out in concentric circles, are connected at the top by timber rings, which approach as nearly as possible to the surface of plates, and offer under it a series of concentric rings, which will support the weight of the iron as soon as it falls a few centimetres.

Considering what has been said as to the possibility of constructing the gasholder exactly according to the prescribed dimension, it will be understood that the heights of the various rings of this permanent scaffolding might be fixed in advance. But it is better to leave the upper timber rings till the work arrives at them, when their proper height can be exactly fixed.

Further, the upper part of this carpentry framing should be composed of two distinct parts—one formed of straight pieces crowning the piles, and situated at such a distance from the plates as not to interfere with the execution of the riveting; the other parts, formed of pieces cut into a circular form, constitute the packing pieces, which fill the space left between the straight pieces and the crown plaiting. These latter pieces add nothing to the strength of the framing, and are only attached thereto by lateral iron fastenings.

After the iron plaiting is all finished, the stays which supported the crown and kept it in a spherical shape are removed, and the plaiting is allowed to rest on the rings of the timber framing; then the floor of planking is removed, proceeding from the circumference to the center, the timber pieces being drawn out through an opening left in the center of the crown. This opening is then closed up, and the tank may be filled.—*Journal of Gas Lighting.*

PUBLIC LAMPS IN NEW YORK CITY

At the adjourned meeting of the Gas Commissioners, held at the City Hall, March 5th, 1877, bids were opened for lighting the public lamps in this city, for *nine months*, from April 1st. The following were the prices bid.

Company.	Gas. Lighting, cleaning, etc.	Lamp-Post straightened.	Column releaded.	Column refitted.	Lamp post removed.	Lamp post reset.	New Lamp fitted up.
Manhattan.....	$12 40	1 50	1 50	3 50	3 50	10	10
Metropolitan..	21.00	2	2	3	3	8	8
New York.....	12.40	1 50	1 50	3 50	3 50	10	10
Harlem.....	24.75	3	3	4	4	10	10
Mutual.....	22.25	1 50	1 50	3 50	3 50	10	10

The New York and New Jersey Globe Gaslight Company; 2,000 lamps at $20 per lamp.

SULPHUR AND AMMONIA IN ILLUMINATING GAS.

Through the kindness of Prof. Silliman and Mr. H. E. Sadler, we have been furnished a corrected copy of their paper on the determination of Sulphur and Ammonia in Gas, to which we call the especial attention of our readers.

Address of Mr. Price at the August Meeting of the New England Association of Gas Engineers.

[Concluded from page 85.]

In regard to our system of conducting business I might say a few words; and then you, gentlemen, can judge for yourselves whether there is anything worth copying.

Our system of accounts is very simple, we have a register in which the name of every consumer is written, with the proper number against each one. When the index books come in the proper entry is made, and the former state of the meter is subtracted from the present index and the proper amount carried into the next column, and from this register the bills are made. We keep no ledger accounts with our consumers, and, of course, the amount of labor is comparatively small.

We collect every month the largest portion of our bills, but we have a good many consumers whose bills we collect weekly; as, for example, the theatres, the hotels, some billiard rooms, some boarding houses, etc., etc. I think it inexpedient to allow a gas bill to run more than one month, of course there are exceptions but, generally, I would collect all gas bills monthly, or oftener.

At the end of each month we have a statement of the month's business, which we regard as of great value. Indeed, we could hardly keep house without it. These monthly statements are so nearly accurate that at the end of any given six months, on taking account of stock, and making an exact balance, the result will vary but little from the aggregate of the statements of the preceding six months. Having found the nett result of the business for the month we analyze the leading items, and ascertain the cost of a thousand feet of gas placed in the holder, then, the cost of the same distributed, and then, the total cost with the leakage added. The value of this system can hardly be overestimated. With such an account before them, at every monthly meeting, the directors are able to understand the exact condition of the business, and if anything is going wrong they know it and can apply the remedy at once; whereas, if the accounts are made up but once or twice per annum, there may have been heavy loss before it is detected. I must not omit to say as an officer, alias, an employee, that the effect of the system I have mentioned, upon those who do the company's business, is most salutary. The certainty of a monthly review of everything done during the preceding month has a powerful tendency to keep every man on the *qui vive* and up to his work. It does us all good to watch us. no man is injured by it, and thousands have been lost for lack of it. I most sincerely hope every company represented here has this system of monthly statements.

In making up the statement I have been talking about, we first ascertain the total amount of income for the month; next, we find the quantity and value of material and labor used in gas making during the month, to this we add the total amount of miscellaneous expenses incurred for the month, and now we have the income on one side and the expenditure on the other—deduct the latter from the former and we have the nett profit for the month; but, in my judgment, the account is not perfect until we have found and deducted from the apparent nett income the total of the interest upon capital invested, a proper per cent. for risk, *alias* insurance, and, also, a proper amount for depreciation. When the total of these three items has been subtracted from the first round nett profit we have remaining the true nett income for the month. This is the system upon which we make up our monthly statements; and, in the same way, we make up our semi-annual statement. The only difference is that, in the latter case, we take account of property on hand and, therefore, the result is declared certain, whereas, the monthly statement is liable to be inaccurate because it is, in some particulars, an estimate.

In answer to a question, Mr. Price said, he was not favorable to the accumulation of a large surplus, ordinarily. He thought the tendency of a large surplus was to induce carelessness, wastefulness, and extravagance. Besides these evils a large surplus had sometimes been too tempting for the managers. and many men have fallen victims.

In regard to danger from unfriendly legislation, Mr. Price said: We, in the Middle and Western states, are under constant menace. I presume you, in the Eastern states, are much less liable to this danger than we. In your section there is much more respect for vested rights, and much less trifling with charters, than in the section where I reside. In Ohio we have been threatened with atrocious legislation. Nearly, or quite, all the Middle and Western states have reserved in their constitutions the right to amend or repeal the charters of corporations. In my state the municipal code gives the common council of a municipality the right to fix the price at which a gas company shall sell gas. At every session of the Legislature our gas companies are threatened with most injurious legialation. A year ago last winter a bill was pressed with prodigious ferocity, providing for the appointment of a commission, by the governor, which should visit every gas company in the State, beginning with the largest, demand its books and papers, the use of fire, room, and lights, where an examination should be made, not only of the books and papers, but also of the officers, agents, and employees who should be compelled, under oath, to answer any and all questions touching the organization and business of the company. It was intended to be thoroughly inquisitorial, and had that bill become a law the effect upon a gas property would have been very injurious if not destructive. Yet, such an infernal bill as I have very faintly described passed the Senate of Ohio, and came near passing the house. Had it been reached, and voted upon, in the house, I believe it would have passed. There is no atrocity which a Western legislative body may not, at any time, perpetrate against a gas company, such is the ignorance and prejudice in regard to that interest.

I fear some gas companies have so conducted their business that this prejudice is, to some extent, deserved; but I do not believe that this is generally true. It is certainly true that it behooves every company to so conduct its affairs as to avoid, as far as may be, this unreasoning prejudice.

On the Volumetric Determination of Sulphur and Ammonia in Illuminating Gas, with a Description of the Apparatus Employed.

[A paper read before the American Institute of Mining Engineers at the Philadelphia meeting, October, 1876.]

By H. E. SADLER and B. SILLIMAN, of New Haven, Conn.

INTRODUCTORY NOTE.

The research here recorded was undertaken early in the present year, and has been prosecuted steadily for about eight months. While the work has been under my constant supervision and advice, the labor has all been performed by Mr. Sadler, to whom is chiefly due the development of the successive steps which have led to the final result. The process is better than I dared to hope, and we are able to place at the command of chemists and engineers interested in the matter an apparatus of continuous and uninterrupted action, and methods of analysis by which the daily averages of the two variable and inconstant factors of illuminating gas, ammonia and sulphur, may be determined with all needful accuracy, even by those little skilled in chemical manipulation, and with very little loss of time.

This research has been carried out in the laboratory of the New Haven Gas-Light Company.

B. SILLIMAN.

October 17, 1876.

INTRODUCTION.

In making some determinations of the sulphur i

coal gas by the Letheby apparatus, the importance of some simpler process was forcibly suggested by tho experience, skill, expense, and time required to obtain trustworthy results. The chances of error were numerous. Insufficient washing of the apparatus, with the liability of breakage in daily handling, the care required in the concentration and in the expulsion of the ammonia, the varying solubility of Barium sulphate in presence of indefinite quantities of ammonium nitrate and free acid, the tendency of that precipitate to run through the filter, the opportunities for loss in the incineration and ignition, the expense of the analytical balance, with the delicacy of manipulation which it requires, and, above all, the time involved from four to eight hours after the gas is burned—all these seemed to place the Letheby test beyond the possible for the practical gas manager.

To escape, without the sacrifice of accuracy, these numerous drawbacks was the end proposed. The result attained is a simple process for the volumetric estimation of the sulphur, dispensing with the balance; and requiring but ten minutes for a determination. The apparatus at the same time affords the working engineer a continued and ready check upon all his purifying processes except the removal of the tar.

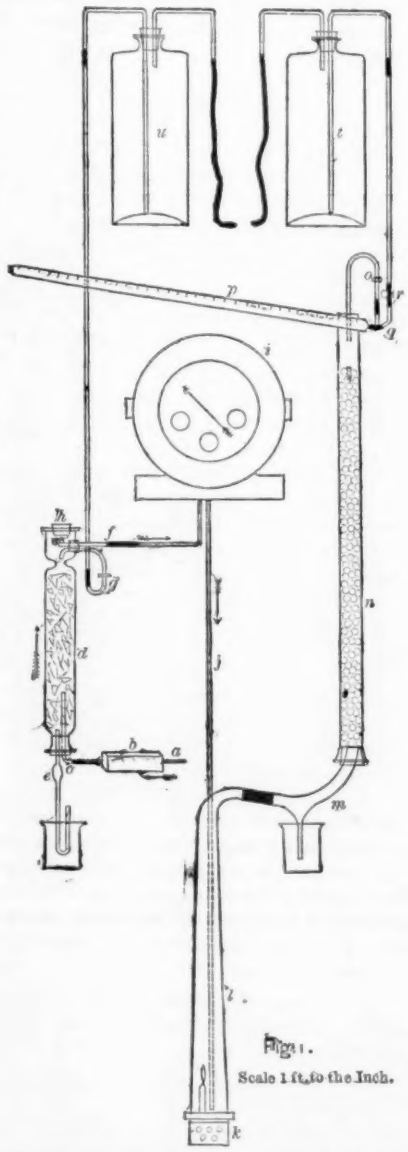

Fig. 1.

Scale 1 ft. to the Inch.

NOTE.—The open beaker shown in the above cut, just under the letters *c* and *e*, should be shown as a closed flask. This is important, as the evaporation from an open vessel would vitiate the determination of ammonia.

DESCRIPTION OF THE APPARATUS.

The apparatus represented in Figure 1 is of glass except the governor *b*, the meter *i* with its connections, and the burner with its case *k*, which are of metal. *d* performs the office of a scrubber. It is an inverted calcium chloride or bubbling tube, of about 600 c. cms. capacity, with a third hole drilled for the admission of the stopper *h*, which carries a wire to support ammonia, acid, and hydrogen sulphide test papers. The larger cylinder is filled with broken glass and supplied with standardized acid from the bottle *u*, by means of the syphon tube *g*; which is fitted with a stop-cock. The gas is admitted by the tube *c*, extending 5 cms. into the cylinder, and the acid escapes into a flask below by the tube *e*, which is bent to form a seal. The meter and burner are substantially those used by the Referees.* The adapter or eductor *l* is 50 to 60 cms. high, the diameter at the base about 7 cms., and the smallest internal diameter at least 1½ cms. *m* has a diameter of 2 cms. with an opening drawn out at the bottom for the escape of the drip from *n*. *n* is a strong tube 3½ cms. in diameter by 80 cms. long, filled with glass marbles, 1½ cms. in diameter. This tube serves as a condenser and also to break up the ascending current from the burner and bring it into intimate contact with a standard alkali, dripping upon the marbles through the tube and stop-cock *o*, from the pipette *p*. This measures 100 c. cms. by halves, and is 60 cms. long. At the beginning of an experiment it is filled by the three-way pipe *q* from the bottle *t*, by opening the pinch cock *r*.

The apparatus is most conveniently mounted against the wall; the meter and bottles standing upon shelves, and the burner and flasks upon swinging brackets. The remaining parts are then secured by clamps driven or screwed into the wall.

MODE OF MANIPULATION.

Solutions of caustic soda or potash and an acid, sulphuric or oxalic, are provided of such strength that 1 c.c has a saturating power exactly equal to 1.10 grain of sulphur in the form of sulphurous or sulphuric acid.† The containing bottles and the pipette being filled, the gas is lighted and regulated by the governor, as near as may be to the rate of ten feet in twenty-four hours. The stop cocks in *o* and *u* are then opened so that 10 c.cms. will pass each for one foot of gas burned.‡ After half an hour or an hour, when the apparatus has attained its normal working, a clean flask is placed under each drip, while the meter and the quantity of alkali solution in the pipette are accurately noted.

When, thereafter, 10 feet have passed the meter, which will be in about twenty-four hours, the quantity of alkail which has flowed from the pipette is determined and the flasks are removed, others being substituted if a test is desired for the following day.

The free and carburetted alkali present in the drip is then to be saturated with the standard acid, but since with litmus and even with cochineal‖ the carbon dioxide obscures the point of neutralization, it is best to add a quantity of acid equal to the total alkali used, and, after removing the carbon dioxide obscures the point of neutralization, it is best to add a quantity of acid equal to the total alkali used, and, after removing the carbon dioxide by boiling the liquid for a brief interval, to titrate back with the standard alkali. The number of c.cms. so used expresses the number of grains of sulphur in 100 feet of gas. For the alkali received in the drip being just saturated by the standard acid, the free acid there will be the quantity caught from the gas. Now, since 1 c.cm. of the alkali finally added is saturated by one-tenth grain of sulphur, one-tenth of the c.cms. added indicates the number of grains caught from the 10 feet burned, and ten times this, the quantity of sulphur in one hundred feet.

The acid solution used in the scrubber is also measured and the acid remaining free determined by the standard alkali. The difference expresses, as in the case of the sulphur test, the number of grains of sulphur which can be neutralized by the ammonia in 100 feet of gas. Since one grain of sulphur neutralizes 1 1-10th grains of ammonia, if the number of c.cms. of acid neutralized by the ammonia be increased by 1-10th, the sum will express the grains of ammonia in 100 feet. This may be accomplished mechanically by having the ammonia measuring-glasses graduated so that 17 divisions shall be equal to 16 c.cms.

The conditions indicated are the most convenient for continuous daily determinations. They are not essential to successful working. On the contrary, two feet of gas are sufficient to give reasonably accurate results, and the apparatus has not proved unequal to a rate of one foot per hour. Moreover, much less acid, run through the scrubber, would be usually sufficient. The quantity of ammonia to be arrested during the period of these experiments was abnormally large, pending a rearrangement of the scrubbers at the works.

EFFICIENCY OF THE APPARATUS.

The following results were obtained from an apparatus which differed from that figured only in that the eductor *l* and the condensing tube *n* were each one-third shorter than described. It was worked first in comparison with the Letheby test, taking the gas from the same supply pipe, and burning it during the same interval, at nearly the same rate, about two-thirds of a foot per hour. From two to four feet, according to convenience, were taken for each experiment.§ The Letheby was supplied with about 100 c.cms. concentrated liquor ammonia. However, this rule was not invariable, and, with three or four of the experiments which cannot now be specified, a weaker solution was used. No result, however, is reported, or was worked out, in which at the end of the burning an exposure of three seconds of the escape failed to turn tumeric paper deep brown. The condensation and washings were evaporated on the water bath to about one-half, acidified with bromine, heated to expel any great excess, precipitated while boiling with barium chloride, allowed to settle, the supernatent liquid, and finally the powder, decanted on to a filter, washed with hot water so long as the washings showed the presence of barium, dried, ignited and weighed, the filtrate being always tested for sulphuric acid.

The other apparatus was supplied with from nine to twelve c.cms. of the standard soda solution for each foot burned. The gas was taken direct from the governor to the meter, without the interposition of the ammonia test, and the drip having been slightly acidified with hydrochloric acid, and further, with bromium water, was boiled, and the combined sulphates precipitated hot with barium chloride, and treated thereafter as in the Letheby determinations.

The following table gives the results;

TABLE A.

Date.	Sulph. Caught Grains per 100 feet.	Sulph. Caught by Letheby. Grains per 100 feet.	Excess over Letheby. Grains per 100 feet.
May 15...	18·64	12·44	6·20
" 16...	19·62	13·70	5·92
" 17...	18·54	14·01	4·53
" 22...	19·33	12·38	6·95
" 23...	18·15	12·11	6·04
" 24...	17·64	11·64	6·00
" 25...	16·58	13·04	3·54
" 26...	14·25	10·21	4·04
" 27..	18·43	10·47	8·43
Total...	161·65	110.00	51·65

Average gain over Letheby, 46·95 per cent.

* First report of the Gas Referees upon the sulphur question, July 75, 1870. Reported in London "Journal of Gas-Lighting," August 16. 1870.

† The standard solutions can be purchased of chemical dealers, and no balance will then be needed. They may conveniently be made of ten times the strength indicated, and portions withdrawn and diluted to this strength as required.

‡ Great difficulty was experienced in securing an uninterrupted and uniform flow of the solutions. The purest distilled water seemed to carry down impurities sufficient to choke the capillary opening of the stop-cocks, which at the proper rate pass but four drops per minute. Filters of Swedish paper, of cotton batting, of fine linen cloth, and of sand, were tried in vain. The simple devise of passing the solution through the stop-cocks in ascending, instead of descending currents, which placed the force of gravity in opposition to, instead of in accord with the slow suction of the streams, afforded instant and complete relief.

‖ Hæmatoxylin was first chosen as an indicator, both because it is the most sensitive to minute quantities of free acid and alkali, and because the change of color, yellow to port wine, is the most conspicuous. But in this solution the reaction was very unsatisfactory. The color changed gradually from yellow to reddish-brown. The absence of metallic salts, at least of the heavy metals, was well demonstrated, and there seemed no explanation of the phenomenon, except that the coloring matter was oxidized by the nitrous acid present and rapidly destroyed. Cochineal was therefore substituted, and proved very satisfactory.

§ It may be remarked that in the Letheby test, as described in Sugg's "Gas Manipulations," the gas is burned in an atmosphere strongly ammoniacal. The products of combustion are carried into a large glass cylinder, where the resulting ammonium sulphite and sulphate fall with the condensing vapor of water, passing into solution. The sulphur is then converted into the form of barium sulphate, and weighed. In the apparatus used, a second condensing cylinder was added, and a trial with a further addition of ten feet of tubing, as a condenser, showed that less than one-half of 1 per cent. of the liquid escaped.

The only means at hand for comparing the new apparatus with the referees is through the Letheby. In their description of their test, before referred to, a table is given in which the following determinations only are strictly comparative:

TABLE B.

Referees.	Letheby.	Excess.
Grs. Sulphur per 100 feet.	Grs. Sulphur per 100 feet.	Grs. Sulphur per 100 feet.
33·4	25·1	8·3
35·5	24·4	11·10
32·6	22·2	10·4
31·8	23·8	8·00
29·2	23·9	5·3
29·6	24·9	4·7
31·17	24·9	6.27
31·4	25·4	6·0
32·27	25·8	6·47
32·8	25·24	7·56
31·6	24·32	6·28
32·96	23·96	9·
34·41	23·35	11·06
35·0	21·86	13·14
34·73	24·92	9·81
34·98	25·82	9·16
34·8	25·24	8·56
35·5	25·4	10·1
36·26	25·12	11·14
27·4	18·4	9.0
28·	19·2	8·8
27·7	23·3	4·4
26·6	20·6	6·0
28·03	20·4	7·63
379·85	577·53	107·68

Aversge gain over Letheby, 34·2 per cent.

And in the place cited, Dr. Odling reports the following comparative workings:

TABLE C.

Referees.	Letheby.	Excess.
Grs. Sulphur per 100 feet.	Grs. Sulphur per 100 feet.	Grs. Sulphur per 100 feet.
26·41	21·04	5·37
25·60	19·32	6·28
21·33	19·76	1·57
21·04	17·48	3·56
94·38	77·60	16·78

Average gain over Letheby, 21·6 per cent.

A comparison of these workings seems to indicate that in efficiency this apparatus does not differ materially from that of the referees; for while the percentage of gain over Letheby's is considerably larger, it will be noticed that the quantity of sulphur to be caught was less, and the actual number of grains caught in excess of the Letheby is in favor of the referees' test. Perhaps no apparatus arrests absolutely all of the sulphur, and the real usefulness of sulphur tests consists in indicating the relative amounts of sulphur in the gas from day to day. A consideration of these tables forces upon one a conviction of the entire worthlessness of the Letheby test for even this purpose, a defect which the experience and carefulness of Dr. Odling himself has not overcome.

A third sulphur test is that of Mr. Y. J. Evans, who drew the products of combustion through an alkaline solution contained in Woulfe bottles. It is to be regretted, in this connection, that no figures could be obtained showing the result of his workings and affording a comparison of the new test with his, and that no opportunity has been offered to compare its simplicity or accuracy with the test devised by Mr. Vernon Harcourt, and described at the last meeting of the British Association of Gas Managers.

[To be continued.]

Notes on the Masonry of the East River Bridge.

[A Paper by Francis Collingwood, C. E., Member of the Society. Presented November 1st, 1876.

[Continued from page 89.]

7th. MATERIALS USED IN MASONRY.—The masonry of the towers below water is mostly of limestone, except the facing of the upper two courses, which is of granite. The backing above high water and below the roadway is mostly granite. all the remainder of the work being granite.

The anchorages were built entirely of limestone, with the exception of the corners, the front arches and the cornice. There were also about 650 cubic yards of heavy granite blocks in each anchorage, placed immediately over the anchor-plates, in order to secure a good hold upon the masonry above.

The limestone used has come from Kingston, Essex, Willsboro Point, and Isle de la Motte, on Lake Champlain, and a small quantity from Canajoharie—all in New York. The granite of the towers has come from Deer Island, Fox Island, Mount Dessert, Blue Hill, Frankfort, Spruce Head, Green's Landing, and Cape Ann—all in Maine; that for the anchorages came from Stoney Creek, Conn.; Westerly, Rhode Island; Frankfort, Maine; and Charlotteburg, New Jersey.

The gravel used in concrete was beach gravel from various points on the north shore of Long Island. It contained a little sand, but was entirely free from dirt. The sand at first used was from Red Bank, off Staten Island; but the excavation for the Brooklyn anchorage furnished an abundant supply for all subsequent work. The cement used has been of the various brands known as Rosendale, no lime having been used at any time. This being a slow setting cement, there is a great advantage in using it where heavy blocks of stone are to be set and adjusted.

The ordinary proportions of sand, etc., used, have been by bulk—for mortar, one part cement and two sand; for concrete, one part cement, two parts sand, and four parts gravel: around the anchor bars and at some other points, the proportions were, one, two, and three. No grouting has been permitted, except in rare cases where no other method was practicable; the general rule being, that all joints must be wide enough, at least for mortar; free use being made of "swords" and rammers, so as to insure perfect filling of joints.

In making up joints in the backing (wherever the spaces were wide enough to admit them) broken stones of irregular sizes from a cubic foot down, were rammed into the concrete, until the spaces would receive no more. Great care was always taken to keep the work clean and to wet the faces of the stone. The face joints were dug ont to a depth of one and a half inches and pointed with pure cement mortar; a bead finish of about a quarter inch projection being put on with a tool. The pointing has never cracked, except when done too late in the season, or where the mortar was allowed to take its first set before using; retempered mortar is sure to crack.

In this connection it may seem proper to state that whenever necessary, the work has been carried on in freezing weather, and no bad results have been observed. The tops of the various pieces of work were always gone over carefully in the spring. The concrete which had been put in late would usually be found disintegrated to a depth of one to four inches; but below this it always was perfectly sound. The rule seemed to be that it was unsound only so far as it was exposed alternately to freezing and thawing, and wherever it had taken a set before freezing, and not been thawed out for some time, it was sound.

The total quantity of joints, both vertical and horizontal, for all the work done up to fall of 1875,* was as follows:

Total masonry laid.....	120,235	cub. yards.
" stone used in masonry.....	100,015	"
Excess of masonry over stone.....	20,220	"
" " " in per centage of amount laid.....	16.8	"

The excess is made up of mortar, concrete, and broken stone; it is probable that the per centage is about 20 for the anchorages and 15 for the towers; but the figures may be modified by the work of the past summer.

8th. THRUST OF ARCHES.—Before construction, a careful analysis was made of the thrust, line of pressure, &c., in the arches under the various conditions of load to which they would be subjected. This showed that the center line of pressures, resulting from the pier only, intersected the bases of the outer shafts at the roadway, at about one third of their thickness from the outer faces; and that with the bridge completed, the intersection at this plane was close to the vertical lines through the center of gravity of the shafts.

The deflection of the center span of the cables is about 128 feet, and of the land spans about 137 feet, and the resultant of pressures from the cable falls in each pier slightly towards the river side of the center line.

9th. IRONS INSERTED IN THE MASONRY—To provide against possible changes of form, or accident during construction of the arches, the following precautions were taken:

At the top of the third vousoirs, 4 heavy irons were anchored into the masonry on each side of each arch, to which 3 inch-round iron rods spanning the arches were attached. Each rod was provided with a turnbuckle for tightening. Aside from serving to stiffen the arches, these rods served a very convenient purpose, as supports for scaffolds, while removing the centers and pointing the joints.

Permanent strengthening bars were inserted in both the first and second courses over the arches; there being in all 6 bars, $5 \times 1\frac{1}{4}$ inches, over each arch, anchored well into the shafts on either side.

Experience has shown the necessity of another precaution to obviate the evil effects of the unequal distribution of pressure over the base of the masonry. By simple inspection it will be seen that the pressure per square foot at the base of the connecting walls is less than half of that at the base of the shafts.* Hence there would be a tendency towards less compression and settlement under the connecting walls, and a consequent bulging upward at the roadway, causing vertical cracks in the connecting walls. This actually occurred to a limited extent in the Cincinnati bridge. To obviate this tendency, bars were inserted in top of the fourth, fifth and sixth courses below the roadway. in all 16 bars, $5 \times 1\frac{1}{4}$ inches, long enough to anchor into the shafts. In addition, the stones of the connecting wall for several courses were clamped together by $1\frac{1}{2}$ inch-round iron clamps.

Three sets of 2×10 inch-steel bars were inserted at each side of the pier, at the roadway, to serve as attachments for the under floor storm cables.

A set of flat iron bars were inserted at 20 feet below the roadway, as attaching points for holding down stays.

20 bars, $5 \times 1\frac{1}{2}$ inches, reaching entirely across the tower, were inserted in the top of the second course below the saddle plates; and in the course below this, 16 other bars, $5 \times 1\frac{1}{4}$ inches. The ends of these bars serve as attaching points for a portion of the long stays to the river and land spans of the roadway.

Small irons were inserted at frequent intervals to serve as attaching points for scaffolding, stairway, &c.

On each pier, on specially prepared beds, 4 saddle plates, each 8×16 feet, and weighing 11 tons each.

All irons were thoroughly galvanized before insertion. The saddles and plates were thoroughly coated with boiled linseed oil.

10th. HISTORY—The contract for the Brooklyn caisson was let October 25th, 1869, and work began upon it soon afterward. With the exception of surveys and office work, this was the first work done upon the bridge.

The diversity of standards and other inaccuracies rendered it necessary to make a complete survey of the various streets, lots and buildings, on the line of the work; and it mey be of interest to state that a line 6,000 feet long, and 300 to 500 feet wide, required four months' time for the completion of the survey.

The first ground was broken on the site of the Brooklyn pier, January 2nd, 1870.

The Brooklyn caisson was launched March 19th,

* Time has not permitted a revision for work done up to end of the present season.

* By this is meant, the pressure at top of the timber or base of the masonry, from the connecting walls themselves, independent of what may be distributed from the shafts.

put in place May 2nd, and the first stone set, June 15th, 1870; the interim between launching and stone setting being occupied, by putting on ten courses of timber, and various prepartory work. Work on the masonry stopped at an ultimate height of 6 inches above tide, December 10th, 1870.* By March 11th, 1871, the chambers of the caisson were filled with concrete, being at the average rate of about 50 yards per day.

It is worth while to note here that the balance of pressure against the caisson while lowering, was decidedly towards the river; and this resulted in a movement outward of the whole mass, of nearly two feet, during the descent. As this had been anticipated, and the base of the masonry made abundantly large, the position was readily corrected at the high-water surface.

March 11th, 1871, the laying of the masonry was again begun; closing December 29th, at 43 feet below the roadway, and 77 feet above tide. April 17th, 1872, work was again resumed: closing November 23rd, at 24 feet above the roadway, and 144 feet above tide. March 20th, 1873, the work was again begun, stopping October 30th, at the eighth arch course or 219 eet above tide. June 22nd, 1874, work was begun again, and closed December 5th, at 267 feet above tide, or 4½ feet below ridge of roof. Early in the Spring of 1875, the saddle plates were set, and the saddles hoisted. All of the remaining stones were set but 78, which had to be omitted until the cables are made.

The total time occupied from the time of letting the first contract was five years and seven months. Reckoning from the bottom of foundation; therefore the average height built per year, was 57 feet. This progress would have been considerably more rapid, had there been no delays from causes beyond the control of the engineering department.

The contract for the New York caisson was let September 6th, 1870; and it was launched May 8th, following. September 11th, 1871, it was put in place; the 17 extra courses of timber (and concrete spaces) were completed between time of launching and October 31st, on which day the first stone was laid.

Stone laying, with the exception of a few very cold days, was continued all winter. This was necessary, in order to give sufficient weight to sink the caisson as the excavation proceeded. May 16th, 1872, the caisson reached its final resting place, and filling in began; the masonry being at this date about 2 feet above tide. The chambers were all filled by July 22nd. Although this time is shorter than that occupied in Brooklyn, the spaces to be filled were proportionally less. The masonry was stopped December 7th, 1872, at 60 feet above tide; begun again April 1st, 1873, and stopped November 22nd, at 6 feet above roadway, or 126 feet above tide; begun again June 22nd, 1874, and stopped December 12th, at 200 feet above tide: begun again April 29th, 1875, and stopped November 27th, at 243 feet above tide; begun again April 10th, 1876, and was finished, so far as possible, until after cable making, by the middle of July, or altogether in about five years and ten months.

Delays have attended this structure the same as the other. The final results show, that under all ordinary circumstances, about five years must be allowed for the erection of such a structure.

[To be continued.]

* The caisson did not reach its lowest point until December 22nd, 1870.

The Manufacture of Coal Illuminating Gas.*

By Alfred P. Trautwein, M. E.

Continued from page 85.

PURIFIER HOUSE.

But little requires to be said in connection with the purifier house itself. It will be 60 feet in length and 54 feet in width, in order to afford accommodation for the four purifying boxes which are placed so as to form a square, the center seal being located between them; it will also include a suitable lime store and preparing floor. The purifying room will be provided with ample wooden ventilators, by means of which the obnoxious emanations arising when the fouled purifying boxes are cleaned, are readily carried off; it will be lighted by means of a number of lamps placed in covered recesses in the walls of the house.

* A Graduating Thesis at the Stevens Institute of Technology.

We have now examined and discussed at some length the several operations constituting, as classed in the outset, the manufacture of coal illuminating gas; though far from being complete our remarks upon this subject should induce the conviction that the gas, prepared as here described, is now practically in a state of purity and is well suited in every respect to the ordinary purposes for which it is intended.

In order, however, to be perfectly sure that such is the case it is customary in all well-managed works to determine from time to time in the course of the day the illuminating power of the gas by means of a jet photometer which is a ready means of accomplishing this end; in many of our larger gas works the amount of impurity in the gas is daily and frequently determined, approximately at least, and any failure of the purifying plant to perform its prescribed duties is thereby immediately detected while it may then be remedied before its consequences assume serious proportions. We have, it is true, described the several processes which gas manufacture proper involves; there are, however, still other operations, intimately connected with our subject, which have not yet been touched upon, but which would now require our attention: we refer here to the operations of storing the gas and of distributing it for consumption.

Resuming our description, then, the gas after leaving the purifying plant will next be passed through the so-called

STATION METER.

This may very justly be regarded as a most indispensable piece of apparatus in every well regulated gas works; its object, as indicated by its name, consists in measuring and recording the quantity of gas made at the works, thereby enabling the manager to see at a glance not only whether the works which is entrusted to his care is in regular working order, but also, by comparison with the quantity of gas actually sold and otherwise accounted for, to judge of his loss by leakage, shrinkage, etc. The great value of the station meter is now generally recognized and its use has now become almost universal; its manufacture occupies the attention of a number of firms, all of which have introduced certain small, though important, improvements in the details of construction. These improvements originated in the fact that it is very essential that the meter shall register with great accuracy, and shall work freely and at a minimum of pressure; a vast amount of ingenuity, therefore, has been bestowed upon it, and the result is the station meter in its present form, as nearly perfect in every respect as can reasonably be desired. Station meters are frequently subjected to a great deal of abuse in the circumstance that in very many cases the quantity of gas which they are compelled to pass, largely exceeds their ordinary working capacity; it is evident that under these conditions an accurate registration is entirely impossible. This will readily be seen when we consider that, since the station meter belongs to the class known as wet meters—being, in fact, merely a consumers' meter on a large scale—it is very liable to inaccuracy, when overworked, from the fact that, when the drum revolves too rapidly, the water level, which properly should be perfectly constant and quiet, is continually disturbed.

In selecting the station meter for the projected works, regard was had to the above considerations: and the following, therefore, will be some of its leading dimensions: Inside diameter of drum 8 feet, length 8 feet; approximate capacity of drum 400 cubic feet. Maximum quantity of gas to be registered per hour, about 21,000 cubic feet; consequently, the number of revolutions of the drum per hour will not exceed 52, at which rate it will probably not cause any serious fluctuations in the water level. The shell will be cylindrical, will be of cast iron, and may be neatly ornamented without considerable additional expense. The meter will be provided with the "tell-tale" attachment, for registering graphically the production of gas during a given period of time; it will be furnished with pressure and overflow gauges, and will have its bye-pass. A thermometer should also be provided, so that the temperature of the gas upon entering the meter, may be observed; the temperature of the gas should uniformly be 60° Fahr.; if it is not, the necessary corrections should be made, in order that shrinkage in the volume of the gas, after leaving the works, may not be credited to leakage. After having been measured in this manner, the gas next enters the

HOLDERS.

These serve the purpose not merely of affording storage for the surplus gas, made during that portion of the day when the consumption is at a minimum, but also of exerting such a pressure upon the gas as is necessary to drive it through the distributing mains, and to deliver it at the consumers' burners under a suitable pressure.

Gas holders, as now constructed, are of two kinds: viz., single-lift and telescopic holders of usually two sections, the joint between the sections being formed by an hydraulic cup.

As a rule, holders of comparatively small dimensions belong to the former class, while holders whose capacity exceeds 100,000—125,000 cubic feet are generally made telescopic; on the other hand, single-lift holders are occasionally constructed with capacities largely in excess of the maximum here given, but it must be conceded, for the following reasons, that in the majority of cases the telescopic holder is much to be preferred to that having but a single section. Taking the case of the latter, we observe that the depth of the holder tank must be fully equal to the height or lift of the holder, while in the case of the telescopit holder the depth of the tank need not exceed the life of the largest section; with the telescopic holder, therefore, greater economy is secured in the cost of excavation for the tank, while the expense for the iron work of the holder itself is not correspondingly increased. In some instances, too, a further point in favor of the telescopic holder lies in the fact that the locality at which the gas holder must be situated, is of a kind which would offer special difficulties in constructing the tanks; beds of natural and hard rock, for instance, are occasionally found to underlie an otherwise valuable site. Under the circumstances, it is true, the depth of the holder tank might be diminished, and its diameter correspondingly increased; such a plan, on the other hand, is generally inadmissible, particularly when real estate is at all valuable.

The telescopic differs from the single-lift holner, simply in the addition of the hydraulic cup for sealing the edges of the upper and lower section. The top and bottom of the cup is generally composed of channel iron, and it is properly strengthened and stiffened with bead or half-round iron along its edges. In all other respects, the details of construction of both telescopic and single-lift holdeas are precisely alike.

The sides of the holder are composed of light sheet iron, which some engineers have claimed need not exceed No. 11 or No. 12, B. W. G. in thickness, no matter what the dimensions of the holder may be. They should, however, be strengthened by means of a number of vertical angle iron ribs, which themselves are suitably trussed. The crown or top of the holder is attached to the sides by means of an angle iron curb; it usually has the form of a perfect segment of a sphere, having as short a radius as possible, in order that, though very light kinds of sheet iron are used, the roof may still be quite self-sustaining.

We will stop here, and again classify gas holders under two distinct heads, viz.: trussed and non-trussed; or, in other words, according to whether or not the top is supported by a series of internal roof trusses. In the trussed holder, the roof frame consists of a number of primary and secondary rafters radiating from the center to the crown, and attached to the angle iron curb; the former are supported by as many primary or principal queen post trusses, radiating from a central king post, and by two sets of independent trusses on the principle of the king post; the rafters are of T

iron, the ties in the trusses of round iron, and the struts of T iron. The main king post is usually a hollow cylinder of boiler iron, of some length and diameter, and is attached to a heavy boiler iron plate in the top of the crown; the lower end is a cast iron, hollow frustum of a cone, around which two wrought iron rings are shrunk for the purpose of strengthening it, and for receiving the tension rods of the principal roof trusses. In addition to this, the roof frame includes two or more concentric circles of angles or T iron purlins.

It should be remarked, however, that the sheets constituting the crown of the holder are not attached to the roof frame proper, but are connected, as already stated, with the sides by the angle iron curb; they merely rest upon the roof trussing when the holder is down, but rise from it, sometimes very appreciably, as soon as the gas enters the holder. This observation has led many engineers, particularly in Great Britain, to attempt to construct holders without any internal roof trusses whatever; their efforts in this direction have met with considerable success, and a number of non-trussed holders of large dimensions have been constructed. In order to prevent the holder from collapsing and "grounding" when in its lowest position it is of course necessary to support the crown in some manner; this is done by providing a stationary wooden frame in the holder tank, and since this may be substantial, but at the same time plain and inexpensive, it is hardly necessary to say that a non-trussed holder thus constructed, is infinitely less expensive than a holder of the same dimensions, but provided, as ordinarily, with roof trussing. Among their advocates may already be included several eminent gas engineers, and their advantages are gradually being recognized. Several serious accidents, however, are said to have occurred, and the chief objection which is being urged against them, is their liability to accident when exposed to the pressure due to the combined influence of high winds and of snow, which, it has been stated on good authority, may, in our Northern states, reach, and at times even exceed 20 lbs. per square foot. The largest holders of this kind, and, with a few exceptions, the only ones which have been constructed in the United States are those of the Cincinnati and Laclede works.

To be continued.

Cause of the Motion of the Radometer.

M. G. Salet.

According to all the experiments made, the cause of movement in the various apparatus resembling the radiometer of Crookes is a difference in the temperature of the surfaces of the discs. The theory of Tait appears the best. A disc, compound or simple, whose surfaces have actually two different temperatures, and which is plunged into a highly rarefied atmosphere, begins to move, the hottest surface recoiling. Whilst the difference of temperature exists the movement continues. There is no occasion to bring forward the possible action of gases condensed on the surfaces. Wherever two thermometers, isolated in a vacuum, and constructed of two different substances, A and B, would indicate different tempe.atures, a radiometer disc composed of adjacent laminæ, the one of the substance A and the other of B, will begin to move and the movement will show the direction and the degree of the difference of temperature. In the circle of lights the discrepancy between the indications of two thermometers, the one with its bulb blackened maintained itself for an indefinite time; it is the same with the movement of the radiometer. Not content with repeating the experiment of Mr. Crookes and M. Fizeau, by placing the radiometer in the centre of a sphere of opal glass so as to equalise the light and avoid currents of air, the author has made an experiment which he considers absolutely demonstrative. He has fixed upon the mill of a radiometer the needle of a compass: the discs were composed of two laminæ of burnt mica, one of them blackened. Under the influence of an adjacent flame the needle deviated to a certain angle, and variations in the lustre or in the distance of the flame were shown very distinctly by a corresponding change in the deviation. The source of light having remained constant for four days the needle kept its position invariable for the whole of the time. The action of condensed gases cannot be invoked here.—*Chemical News.*

Correspondence

[Correspondents, in all cases, should sign their communications with their names and address in full—not for publication, unless desired, but as a guarantee of good faith.—Ed.

Gas from Petroleum.

Shelbyville, Ind., Feb. 21, 1877.

Mr. Editor: It would be a most presumptuous thing for me to assume the task of critisizing Mr. Price, but in his address before the New England Association of Gas Engineers, he makes some statements that do not accord with our short experience.

Just here let me say that I have no interest whatever in any patent process, and that my knowledge of gas works is extremely limited, and confined entirely to the experience of our own works.

Our little city was first lighted in April, 1874, since which time we have constantly supplied public lamps and private consumers. We make gas entirely from *crude petroleum*, not benzine or naphtha. At first we used the gas pure in small burners, but the difficulty in keeping the street lamps from blowing out caused us to introduce larger burners, and we now use ordinary 3-foot tips, using *air* as a diluent. In the erection of our works the great mistake of small mains was made, and I think it probable that no other works will equal us in that particular. We have about 4½ miles of main, leaving the holder with 400 feet 4 inches, reducing to 3 inches 2000 feet, then branching off with 3 and 2 inch, largely the latter size, and in two places supplying public lamps and consumers at the end of six hundred feet of 1-inch pipe.

Now, it does seem to me, that if, as Mr. Price suggests, the mains, services, and house pipes choke up, and this *nasty, stinking substance which "gets on your fingers when you turn on the gas,"* is such a great trouble and the natural result of oil gas works, we ought to be having some of the experience. But alas for his information, our mains, services and pipes are evidently as free and clear as they were when the gas was first turned on. We do occasionally get a spoonful or two of what I suppose is condensed gas, out of a meter or trap in a service (but never in a fixture or past the meter), which does not smell as sweet as the "balm of a thousand flowers," but only the gas man is supposed to get after these places, and his nostrils are used to the sweet perfumes of tar and such other delightful smelling products of coal or oil as gas works produce. As for the destruction of meters I can only say that out of one hundred set before the 1st of July, 1874, only six have needed repair, and every one has been in constant use. This objection, however, may be well taken, as it will require a longer time to demonstrate the truth or falsity of it,

Mr. Price does not know of a town where oil is used and the consumers are pleased with it. If he will travel a short distance toward the "Course of Empire" and visit our little Hoosier city, I will take great pleasure in introducing him to an entire community, who are so well pleased with the quality of gas we furnish them, that if any of them at any time visit any of the larger cities where coal is used it is sure to result in our gas getting many complimentary remarks on their return home. As an evidence of this, at the end of three years, every one who ever burned gas in our town (except one) is burning now, and the exception says he would like to burn gas but coal oil is a little cheaper.

Mr. Price speaks of the constant accumulation of *soot*—he does not say where, but I presume he means in the retorts. We have had our retorts choked up perfectly tight in less than half an hour, but it was simply a consequence of too *high a heat, and has no more business to occur than no water in a steam boiler.*

Respectfully,

Amateur.

The Commission Business.

Knoxville, Tenn., Feb. 23, 1877.

Mr. Editor: In regard to your remarks on commissions in the last issue of the Journal, I do not suppose that gas managers in this country are more honest than their English brethren. As far as my experience goes, I find we have not the temptation to resist as they seem to have, owing to the fact that our firms and dealers in gas works material do not resort to commission or bribing to sell their goods. In this respect they stand in bright contrast with their class in England. And I think this is a good opportunity to bear testimony to the high character of our dealers, and to assure them that the course they pursue is appreciated by us. I simply wish to point out to you that it is owing to the high and honorable practice of our dealers that the *commission* business is not in vogue amongst us, as it is in England, and that you might make mention of it, if you have occasion to refer to the subject again. Yours truly,

James Somerville,
Sec. and Sup't Knoxville Gas-Light Co.

Tar as Fuel.

Philadelphia, March 9, 1877.

Mr. Editor: I do think in the cause of Science that you ought not to permit the deductions of the paper signed "J" to go out in your Journal without dissent. The whole confoozelum about "increase of heating power by the proper use of water" is worthy of the schools in Alice's wonder land, if there any in that country.

It will not pay to go over the computation. The gist of the conditions are that at about 800° Fahr. under atmospheric pressure nearly, the disassociation of water will occur to such a degree that when in juxta position with a hydrocarbon, or carbon in *some* chemical condition or association—not isolated—a rearrangement of chemical combinations will occur.

So far as the decomposing of the water is concerned, it will be accompanied by the expenditure of 62,000 units of heat (English) for each pound of hydrogen released, or 6,900 units of heat for each pound of water decomposed. In burning any hydrocarbon to its best results for giving out heat, that is to water (H_2O) and carbonic acid (CO_2) a certain quantity of heat will be eliminated. The use of water in the process of effecting the combustion may be advantageous in preventing the escape of unburned carbon as smoke, or partial combustion as carbonic acid (CO). There is good ground for such use in practice, but there is not the least practical or theoretical basis for the opinion that the quantity of heat proceeding from a given fuel can be increased by the addition of water (more or less in relative quantity) decomposed by the heat of the same fuel. Respectfully yours,

Robert Briggs,
Civil and Mechanical Engineer.

Gas-Light Intelligence.

United States.

Milwaukee Gas-Light Co.—Mr. J. H. Walker, formerly engineer and superintendent of the works of this company, having resigned that positton and opened an office at No. 408 Milwaukee street, Milwaukee, Wis., as consulting and constructing gas engineer, his place has been supplied by the selection of Mr. C. R. Faben, late superintendent of Toledo Gas Works.

Cambridge Gas-Light Co.—Mr. William Gibson having resigned the positien of engineer and superintendent of this company, Mr. H. A. Allyn, formerly of Brookline, has been appointed to that position.

Brookline Gas-Light Co.—Mr. Chas. F. Spaulding, formerly of Burlington Gas-Light Co , has been appointed engineer and superintendent of this company, in place of Mr. Allyl.

Gas Notice to the Public.—All persons are hereby notified not to purchase any shares in the capital stock of Moberly Gas-Light Co., or any interest in any such shares, of G. F. Rothwell, as any agent or attorney, as said Rothwell has no authority to act for me or in my name—any such pretended authority having been obtained by fraud and misrepresentation. Further notice is given that I am the lawful President of said company (having been duly elected in August, 1876, for one year) and no bonds, notes or liens purporting to have been given by said company are, or will be valid, unless bearing my signature as such President.

G. B. Dunne,

for himself, and as President of the Moberly Gas-Light Company.

Moberly, Mo., January 4, 1876.

Mayor Ely, Comptroller Kelly and Commissioner of Public Works Campbell, acting as a gas commission, met at the City Hall yesterday. The following awards were made for lighting the public lamps of the city for the nine months ending December 31, 1877:—

New York Gas-Light Company, south of Grand street, $12.40 per lamp.

Manhattan Gas Company, between Grand and Thirty-fourth streets, $12.40.

Mutual Gas Company, between Thirty-fourth and Seventy-ninth streets, $22.25.

Metropolitan Gas Company, between Thirty-fourth and Seventy-ninth streets, except the lamps situated east of Third avenue and between Fifty sixth and Seventy-ninth streets, $21.

Harlem Gas Company, between Seventy-ninth street and Harlem River, except lamps situated between Fifth avenue and East River, north of Seventy-ninth street, $24.75.

New York and New Jersey Globe Gas-Light Company, between Fifth avenue and East River. The lamps north of Seventy-ninth street and east of Third avenue, between Fifty-sixth and Seventy-ninth streets, $20.

It is stated in the Department of Public Works that the actual saving by these awards over 1876 will be $74.000. The rejected bids showed an increase over 1876 of $111,000.—*N. Y. Herald.*

Country Laboratory Apparatus.

No. I. Flower-Pot Gas-Furnace, Crucible Jacket, etc. No. II. Rough and Ready Method of Estimating Volatile Matter and Coke in Coal.

By Edward T. Hardman, FCS.
H.M. Geological Survey, Ireland.

No. I. The following short description of an extremely effective, cheap, and cleanly substitute for crucible jackets, etc., may be useful, especially to those who, like myself, have occasion to shift their quarters often, and are obliged to work with a necessarily limited laboratory accommodation.

The ordinary crucible jacket being made of sheet-iron has in reality but one use—to protect the flame from currents of air. The small concentration of heat which it affords may be regarded as nearly *nil*, since, from the nature of the material and its thinness, radiation takes place very freely.

Another drawback it has, is that it soon becomes rusty or coated with scale. It is not only dirty to handle therefore. but also presents the inconvenience of dropping some of its scale into the crucible if not carefully manipulated. Then it is an awkward thing to pack, taking up a good deal of space, rusting everything it comes in contact with, and behaving generally in a disagreeable manner; while, as it is not to be obtained in country towns, it may net be left behind.

Now an ordinary earthenware flower-pot answers the purpose in every respect. It is the proper shape, and being made of a non-conducting material it in a great measure prevents loss of heat from the burner. It is extremaly cleanly to use, and last but not least, it can be procured in every town or village at the small cost of one halfpenny or so; that there is no necessity to cumber oneself with it when moving.

The bottom of the flower-pot has a circular hole. This serves for the introduction of the Bunsen burner. As the supply of air would be insufficient otherwise it will be necessary to enlarge the opening. This can be easily done with a knife, and I find it best to cut the aperture nearly in the form of a cross, and not too large. One or two trials will give the happy medium. A current of air is then obtained which not only steadies the flame, but acts in some degree as a blast. The flower-pot may be supported in the ring of a retort stand in the usual way. The chimney is a second flower-pot inverted. To support it the handiest way will be to make three S hooks of stout wire, and having passed the narrow end of the pot upward through the ring, fix the rim within the hooks caught on the ring.

It will be found convenient to devote a small retort stand permanently to the purpose.

This will be very handy, as the upper part can be raised to any desired height, regulating the heat and draught; or can be shifted from side to side, whenever it is desirable to inspect the progress of the operation going on.

The apparatus acts admirably as a small gas furnace for crucible operations, such as the fusion of silicates with carbonate of soda—as in the analysis of rocks; while for simple ignition of precipitares it renders the flame of a common glass spirit lamp most effective. The size of the flower-pot required will, of course, depend on that of the crucible and of the burner used. I find the smallest size, 3½ inches high and about 8 inches diameter at top (internal) most generally useful.

The support for the crucible may be either a triangle of wire covered with pipe shank, the end of the wire being bent upwards and formed into hooks so as to hang on the edge of the flower-pot, or three pipe-covered wires suspended in the position of the ribs of a crucible jacket. The former is necessary for small crucibles.

The flower-pot also makes an excellent lamp-screen, for steadying and concentrating the flame under evaporating basins, etc.; of course a sufficient interval must be kept between the pot and the basin else the light will be extinguished.

A small flower-pot with wire gauze tied over the top is a very effective low temperature lamp when the gas is lighted below the gauze. If the gas is lighted above the gauze we have a capital argand lamp giving a large clear blue flame. In the latter case a common burner can be used, a consideration when Bunsen's are all temporarily occupied or not available.

After a time the pots become cracked from the heat, but as they are easily replaced this does not matter, and even when cracked they will often hold out for a considerable time. Fireclay flower-pots made rather thick would, however, afford a really good cheap and portable furnace.

It has just occurred to me that by placing the flower-pot inside another just large enough to encase it, loss of heat by radiation would be effectually checked.

No. II. The usual method of estimating the volatile matter in coals implies a laboratory on rather an extensive scale. A furnace with a good draught is required. The coal is placed in a large porcelain crucible, which is then put into a Hessian crucible, and covered with powdered charcoal to exclude air. The cover being then put on, the whole is exposed to strong heat in the furnace for an hour or two, when the volatile matter is driven off. After cooling the difference of weight against that determined before ignition gives the volatile matter. Having occasion to determine the volatile matter of a coal, and not having at hand the elaborate arrangements referred to above, I bethonght me of the scoolboy's method of manufacturing coal gas. The retort he uses is a common clay tobacco pipe. A piece of coal is put in, the top is luted with clay, and the pipe is inserted in the fire grate with the stem projecting. Presently a dense smoke issues from it, and a match being applied a veritable gas light—but not "16-candle"—results. On opening the luting a piece of coke is found in the pipe. I suppose most of us have performed this experiment. It is obvious that it is only necessary to weigh the pipe and contents before and after the operation, and we have the volatile matter and coke determined.

The larger the pipe the better. Those I have used hold about 100 grains of coal broken small but not powdered. The pipe is weighed, then filled with the coal and weighed again to obtain weight of coal. Then inside the top is fitted a circular piece of writing-paper, the use of which is to prevent any of the luting getting down among the coal, where it could not be removed, and would falsify the last weighing. The top is luted with moist fireclay, or with the cement used for luting the covers of gas retorts, and the pipe, being placed in a common coal fire or in a gas furnace—that described above (No. I.) answers very well—from ten to twenty minutes completes the operation. When cool the luting is carefully taken off and the charred paper removed. The pipe and contents then being weighed, the loss gives the volatile matter, the same weighing, of course, determining the coke. If a very exact determination is required, a quantity of the coal may be broken very small, well mixed together, and four pipes filled as above. They can all be ignited together in a fire, and weighed very quickly. The results will be found to agree very closely.

The figures thus obtained do not differ from those given by the same coal assayed on the laboratory plan to a greater amount than will be fonnd to occur between two experiments made on the same coal in the latter way. And the tobacco pipe process has the great advantage of being very expeditiously performed—the whole experiment including weighings not occupying more than thirty minutes—and with very simple apparatus.—*Chemical News.*

A Chapter of Kerosene Accidents.

Burned to Death.—Late on Thursday night, at Orange Valley, N. J., Mrs. Pauline Willie, whose husband keeps a saloon there, attempted to extinguish a kerosene oil lamp by blowing it out, when an explosion occurred and Mrs. Willie was burned so dreadfully that she died yesterday morning.—*N. Y. Telegram.*

A Shocking Fate.—Mrs. James Maxwell, the woman who was so terribly burned on Friday by the explosion of a kerosene lamp at her house, No. 410 Mulberry street, Newark, died yesterday, after suffering excruciating agony for forty-eight hours.

A Woman Burned to Death.—Mrs. Mulligan, of 293 Atlantic avenue, Brooklyn, was so terribly burned by the explosion of a kerosene lamp last night that she died from the effects of her injuries this morning.—*N. Y. Telegram.*

Disastrous Fire Caused by the Capsizing of a Kerosene Lamp;—The late disastrous fire which occurred at 24 Ludlow street, at 7.15, on the evening of the 11th inst., was attributed to the capsizing of a kerosene oil lamp by a little girl. The child's dress caught fire and communicated it to some clothing in the room, and in a moment the whole apartment was ablaze.

A Kerosene Lamp that Caused a Loss of Fifteen Thousand Dollars.—About seven o'clock yesterday morning a fire broke out in the cellar of No 509 Bushwich avenue, Williamsburg, which totally destroyed the two three-story frame buildings, Nos. 507 and 509, and gutted No. 511. At half-past nine o'clock last evening the fire again broke out, but no further damage was done, as the second fire was confined to the ruins.

The conflagration was caused by a servant girl dropping her kerosene lamp in the cellar while getting her kindling wood. The girl gave the alarm and made her escape as did all the inmates of the houses. The buildings were at such a distance from any engine house, that when the engines reached the ground the fire had obtained such headway that a portion of the building No. 511 only could be saved.—*N. Y. Herald.*

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FRIDAY, MARCH 16, 1877.

Report to the Gas Committee of the Corporation Gas Works, Bolton, England.

[From the London Journal of Gas Lighting, Jan. 16.]

Mr. Harrison Veevers, the engineer and manager of the Corporation Gas Works, has made a report to the Gas Committee upon the business of the department for the past month, which contains some interesting information. He says:

The following tables give information on the manufacture of gas, etc., in the months of December, 1875 and 1876:

	Dec., 1875.	Dec., 1876.
Gas made in feet	64,763,000	68,078,000
Increase per cent		5 12
Cannel used—tons	2,446	3,093
Coal used—tons	3,667	3,090
Cannel and coal—total	6,113	6,183
Make per ton in feet	10,554	11,100
Retorts in use, Nov. 30	440	440
Retorts in use, Dec. 31	440	468
Stokers employed, November 30	92	92
Stokers employed, December 31	92	97
Artizans and Laborers	134	180
Clerks, meter inspectors, etc	32	32

The continued use of a greater proportion of cannel referred to in the last report, has had the effect of improving the illuminating power, which has been better during this month than in either of the two preceding ones. Having the assistance of 28 of the retorts in the new stack at Lum street, the manufacture of gas has been conducted much more satisfactorily than during the corresponding period of last year. With the exception of a stoppage of the centre-valve of one set of the purifiers at Lum street for a few hours on the 27th, which caused a cessation of work of about 100 retorts, no irregularity has occurred.

The amounts of cash received are as follows:

	Dec. 1875.	Dec. 1876.
Gas	£802 8 4	£1545 9 8
Meter rents	22 16 4	42 9 4
Meters and fittings	639 7 3	214 13 9
Washing liquor	10 14 0	4 8 6
Ammoniacal salts	415 0 2	962 6 8
Tar	359 16 11	2 1 8
Coke	457 9 8	273 15 6
Spent lime	20 19 1	21 10 11
Deposits	236 5 0	271 5 0
Rents	17 11 9	9 11 3
Sundries	1 8 3	4 9 2
Transfer fees	0 2 6	0 0 0
	£2983 19 3	£3352 1 5

The facts that in this month there were 412 cases of repairs, etc., attended, as against 330 in December last year; and 230 new meters fixed, against 154 a year ago, indicate a healthy activity in the fitting department. Of the 230 meters fixed 76 were renewals, and of the 154, 67 were to replace old ones. The principal work has been fitting the mills of Mr. Briggs, and of Mr. Constantine, the St. Bartholomew's Schools and the new tramp ward.

In addition to the remedying of escapes and other defects in mains and services, the main-layers have done the following work:

9-inch mains, cast iron	90 yards
4-inch " "	171 "
3-inch " "	3 "
2-inch " "	1050 "

There were also laid the following services:

½-inch lead	61
¾-inch "	8
1-inch "	10
2-inch cast iron	2
	81

Being three more than in December, 1875.

During the years and half years ending December 31, 1875, and 1876, the following results have been attained, which are satisfactory as indicating a progress in the manufacturing department as great as can be expectected.

	Years ending Dec. 31, 1875.	Dec. 31, 1876
Cannel and coal used—tons	38,248	38,947
Gas made, in feet	401,209,000	412,088,000
An increase of	...	2·71
Make per ton, in feet	10,489	10,580
	Half years ending Dec. 31, 1875.	Dec. 31, 1876.
Cannel and coal used—tons	19,942	20,267
Gas made, in feet	212,509,000	220,175,000
An increase of	...	3·6
Make per ton, in feet	10,656	10,863

The last item is instructive, as it shows an increased average yield per ton on all the cannel and coal used during the half year of 202 feet, or a total of 4,094,000 feet. This may be accounted for by the fact that the retorts are in better order, and the cannel and coal of better quality.

A Single Track Railroad.

The San Francisco *Examiner* of November 25th, says:

Yesterday the steamer Sonoma conveyed to Norfolk, on Sonoma Creek, a number of our citizens who assembled to witness the opening of the Prismoidal Railroad. The road commences at Norfolk, and extends three and a-half miles towards Sonoma. The steamer arrived in good season at Norfolk, the terminus of the Sonoma Valley Prismoidal Railroad, where the party landed, and at once proceeded to inspect the line and the works generally. The Prismoidal Railroad is laid upon a prism of wood built of bevelled boards, forming a continuous prism 27 inches wide at the base and 15 inches high, with the single rail laid on the top. The car which travels on the line is supported by two wheels, one at the front and one at the rear, with independent revolving flanges. On arrival, the first thing to be done was to test the road, and in a few minutes platform cars, with a prismoidal railway locomotive between them, were at the stations. This locomotive is the first of its kind constructed in this state, and was built under the superintendence of Geo. W. Fogg, of the Pacific Iron Works. The party took their places on seats that were ranged on each side of the cars, the passengers being face to face. The first impression suggested was that which ordinarily fills the bosom of the novice who makes his maiden effort to ride the uncertain bicycle. A certain assurance that the whole thing would topple over at the first movement was the belief of the unitiated. But the engineer sounded his whistle, the passengers gave their tremulous cheers, and the train moved off smoothly, and soon the pace was considerably augmented. Wonderful to relate, the oscillation was scarcely perceptible, and the locomotive and cars rode the single rail as firmly as the trains on the broadest of English solidly constructed broad gauges. The faster the train proceeded, the smaller in number and extent became the lateral oscillations, beautifully and practically exemplifying the great principles of the prismoidal system, that the greater the speed, the less the liability to oscillate, a principle clearly demonstrated by the gyroscope and velocipede. To those making their first trip on the new railroad, the ease and comfort of this mode of travelling suggested itself most strikingly. The train was run out to the end of the completed line, where 45 men were found continuing the building of the prism onward. The construction of the road has cost, for the present three miles and a half, including the cost of the road bed over the marsh, about 4,500 a mile, one-half of the cost of the narrow gauge railroad, the most economical of the two rail system. The road was commenced on the 16th of August last by the building of the road bed.

Origin of Petroleum.

Mr. H. Byasson has been led to the following experiment to give a scientific explanation to the formation of petroleum:

If a mixture of vapor of water, carbonic acid, and sulphuretted hydrogen be made to act upon iron heated to a white heat in an iron tube, a certain quantity of liquid carburets will be formed. This mixture of carburets is comparable to petroleum.

The formation of petroleum can thus be naturally explained by the action of chemical forces.

The water of the sea penetrating into the cavities of the terrestrial crust, carries with it numerous materials, and especially marine limestones. If the subterranean cavity permits these new products to penetrate to a depth where the temperature is sufficiently high, in contact with metallic substances, such as iron or its sulphurets, we have a formation of carburets. These bodies will form part of the gases whose expansive force causes earthquakes, volcanic eruptions, etc.

Petroleum is always found in the neighborhood of volcanic regions or along mountain chains.

In general it will be modified in its properties by causes acting after its formation, such as partial distillation, etc. Petroleum deposits will always be accompanied by salt water or rock salt. Often, and especially where the deposit is among hard and compact rocks, it will be accompanied by gas, such as hydrogen, sulphuretted hydrogen, carbonic acid, etc.—*Revue Industrielle.*

Krupp Guns.—English artillerists are directing their attention to the latest invention of Herr Krupp, viz., an armoured gun which does away with the recoil of heavy siege, coast and naval guns. When fired, the new armor gun remains fixed in its original position, so that when once pointed, relaying after every shot is dispensed with, and a rapidity of fire—60 rounds in 15 minutes—is attained. The gun is armored by a metal sphere being screwed round the muzzle, the thickness of the armor corresponding to the calibre of the weapon. In firing from forts the size of the embrasures is reduced to that of the bore of the gun, and the smoke, which has hitherto made a prolonged stay in the casemates insupportable is blown away by having to remain outside. With the great stability of the gun, fewer gunners and less space are required. Extensive trials are about to be made against these armored guns, with the object of determining what chances there are of an enemy disabling a weapon thus protected. The experiments are looked forward to with interest.—*British Mail.*

Gas Stocks.

Quotations by W. B. Scott & Co., Bankers,
24 Pine Street, New York City.
March 16, 1877.
☞ All communications will receive particular attention

	Capital.	Par.	Bid.	Asked.
Gas. Co.'s of N. Y. City.				
Harlem	$1,850,000	50	105	110
Manhattan	4,000,000	50	220	225
Metropolitan	2,500,000	100	145	150
" Scrip	$1,000,000	...	100	103
" Bonds	500,000	1000	100	103
Mutual	5,000,000	100	101	103
" Bonds, gold.	900,000	1000	105	—
Municipal	1,000,000	100	70	80
New York	4,000,000	100	130	131
Gas Co.'s of Brooklyn.				
Brooklyn	2,000,000	25	175	180
Citizens	1,200,000	20	98	102
" Scrip	320,000	1000	95	97½
Peoples	1,000,000	10	45	50
" Bonds	$ 325,000	...	--	95
" Scrip	300,000	...	85	—
Metropolitan	1,000,000	100	76	80
Nassau	1,000,000	25	80	85
" Ctfs.	700,000	1000	96	98
Williamsburgh	1,000,000	50	130	135
" Scrip		...	98	100
Out of Town Gas Companies.				
Bath, Maine	70,000	100		
Buffalo Mutual, N. Y	750,000	100	—	80
" Bonds	200,000	1000	—	90
Baltimore, Md	2,000,000	100	134	134
" Ctfs., gold	1,000,000		106	110
Bayonne, N. J		100		90
Brockport, N. Y	25,000	100	...	80
Citizens, Newark	918,000	50	98	100
" " Bds.	124,000	—	—	--
Derby of Conn	160,000	100	60	80
East Boston, Mass.		25	132	----
Fort Wayne, Ind		100	...	--
Hannibal, Mo	100,000	100	95	100
Hartford, Conn	700,000	25	180	184
Hempstead, L	25,000	100	...	—
Jersey City	386,000	20	160	—
Jamaica, L. I	25,000	100	...	—
Jacksonville, Ill	120,000	50	82	...
Lewistown, Maine	400,000	100	50	85
Lima, Ohio	60,000	100	--	...
Bonds	30,000		90	
Laclede, St Louis Mo	1,200,000	100	100	110
Peoples, Jersey City		...	120	125
Peoples of Albany	650,000	100	—	20
" Bonds	350,000	1000	--	--
Peoples of Baltimore		25	76	—
" Bonds			106	—
Perth Amboy		25	—	95
Rochester, N. Y		100	50	60
Richmond Co., S. I.	300,000	...	97	100
Woonsocket, R. I	150,000	100	100	...
Halifax N. S	400,000	40	148	150
Hamilton, Ontario	150,000	40	112½	
San Francisco Gas-Co., S. Fr'isco Cal.			99	100
St. Louis, Missouri	600,000	50	73	75
Stillwater, Minn	50,000	50	—	26
Suburban, W'stch'str	390,000	50	—	100
Saugerties, N. Y	15,000	100	110	115
Troy, Citizens	600,000	100	—	100
Central, Westchester	466,000	50	90	95

The following Gas Stocks were sold at auction, on the 14th inst., by A. H. Muller & Co.--

$637 50 100 Williamsburgh Gas Scrip, @ 101; five shares Municipal, @ 70; 66 shares Nassau, Brooklyn, @ 83½; 30 shares Citizens, Brooklyn, @ 93½; 10 shares Harlem, @ 109½; 10 shares Metropolitan, of New York city, @ 144; 129 shares of same, @ 143¾—144.

FOR SALE,

HALF INTEREST IN A SMALL AND PROFITABLE GAS WORKS in a thriving town of four thousand inhabitants. Has 2000 feet Natural Gas per day. For particulars apply to A. W. MORTON
426— 22 Platt Street, New York.

IMPROVED METHOD OF REMOVING
CARBONACEOUS INCRUSTATIONS
FROM
CLAY RETORTS,

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Having been now fully tested by many of the largest Gas Companies in the United States and England, this method is submitted to Gas Managers with the fullest confidence that it will accomplish the desired result at the smallest possible expense and inconvenience.

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St. Louis Gas-Light Co., St. Louis.
New Orleans Gas-Light Co., New Orleans, La.

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CATHELS'S IMPROVED
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Colored Lithograph copies of WORKING DRAWINGS of Beds of One to Seven Retorts (so clearly arranged and fully shown, as to be easily understood by any Retort Setter or Bricklayer) having been made of these Valuable Settings, they can now be supplied with detailed SPECIFICATIONS, at reduced rates, immediateely on receipt of orders.

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Is an excellent Cleanser of Gas from Tar, Ammonia, Sulphur, and Carbonic Acid, reducing the cost of subsequent Purification 30 to 50 per cent. Needs no motive power or attention, beyond drawing off and re-charging as required. Has no moving parts or complications to get out of order. Is of moderate cost, and is practically indestructable.

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JOHN JOHNSTON, Marine and Fire Ins. Bank.
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C. W. LOBDELL, Pres't Moline, Ill., Gas Co.
J. J. RANDALL, Winona, Minn., Gas Co.
JAMES RUSSELL, Superintendent Winona, Minn., Gas Co.

WHEELER & WINTERTEEN,
INSPECTORS OF
Gas Meters and Repairers.

Gas Companies having Meters to be repaired will please inform us. The best references given from different Gas Companies and State Inspectors. Address for terms, office, 513 Fourteenth St., Washington, D. C. 411-unt

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GAS SUPERINTENDENT,
425—2t Office of this Journa

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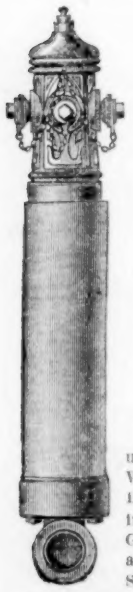

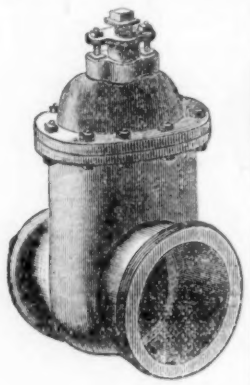

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15″×24″×9′	"	24.50

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Superior in every respect

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Orders can be partly filled within three weeks of receipt.

Improved "Settings," Furnace Brick, Etc.

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HEAVY AND LIGHT CASTINGS OF ALL KINDS.

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SHOVELS AND SCOOPS A SPECIALTY

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COKE SCREENING SCOOPS.

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Perfect in their operation, is very strong, and from their great durability vastly more economical than any substitute. Refer to all the principal gas Companies in the country, who acknowledge them as the "ne plus ultra of Coke Screening Shovels.

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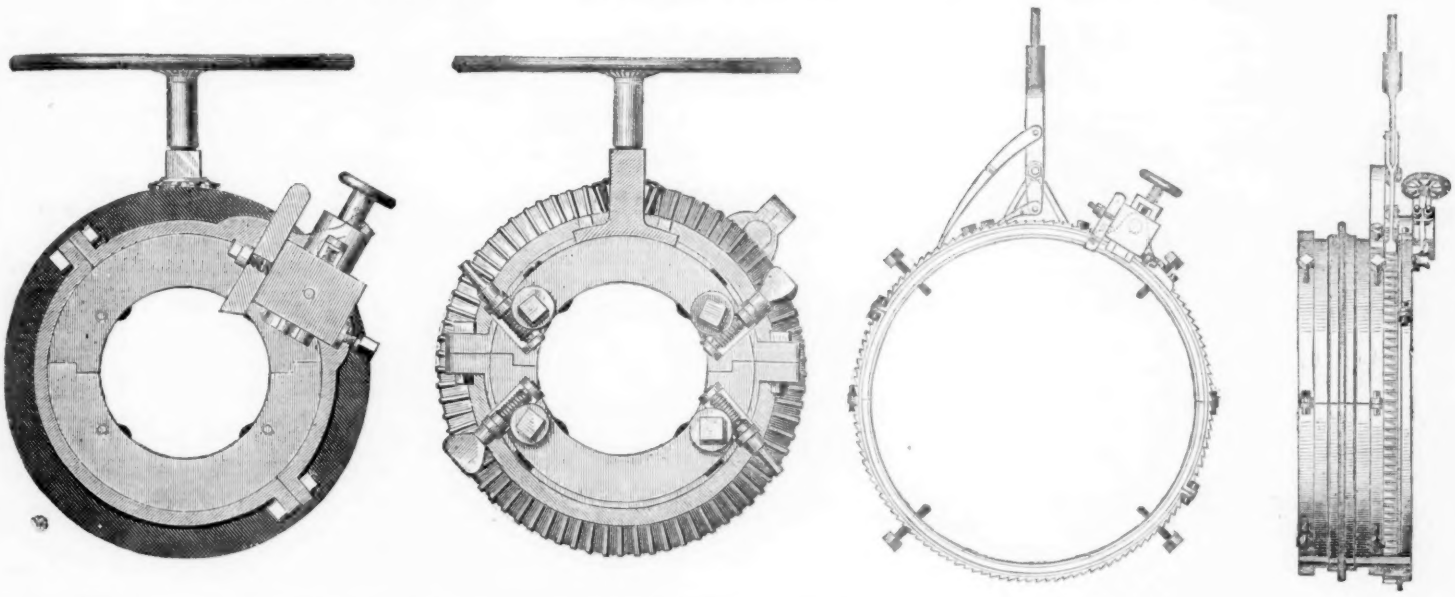

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Our Machines for cutting 30-INCH PIPE have been furnished to the Manhattan and New York Gas Light Companies, and operate to their entire satisfac
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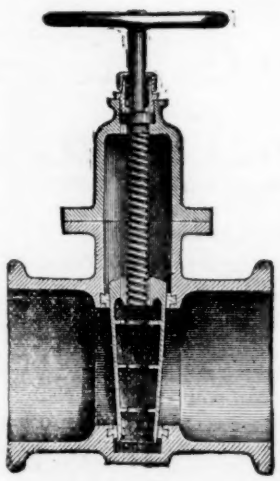

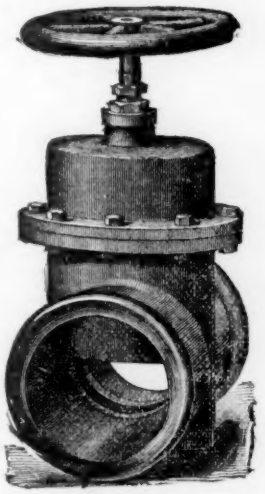

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PEOPLES GAS-LIGHT COMPANY, BROOKLYN, N. Y.
CITIZENS GAS-LIGHT COMPANY, BROOKLYN, N. Y.
SOUTH BOSTON GAS-LIGHT COMPANY, BOSTON, MASS.
CHARLESTOWN GAS-LIGHT CO., CHARLESTOWN, MASS.
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acknowledged to be the most valuable ENRICHER produced in this country, a gross ton yielding 10,000 cubic feet of GAS of 64·54 CANDLE POWER; COKE 32 bushels, of good quality.

CANNELTON CAKING COAL.

MAXIMUM YIELD, 5.06 cubic feet of Gas per pound of Coal—A yield of 4·78 cubic feet per lb.—gave 16 14-100 Candle-Power.

COKE, of very fine quality—1453 pounds produced from one ton of coal.

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Offer for Sale the

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DOUBLE SCREENED,

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The facilities of the WAVERLY COMPANY are unsurpassed by those of any other Company on the Youghiogheny.

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The undersigned are prepared to execute orders for the

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For delivery at any Port in the United States.

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351-1y

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FROM WEST VIRGINIA.

Yields over 13,000 feet of Gas per ton. At ten thousand feet (standard yield) the illuminating power is over 43 candles. Purifies 4,510 feet to the bushel of lime.

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This process has been fully tested nearly 50,000,000 cubic feet of Gas having been made under it, and fully demonstrating the fact that it is the greatest improvement ever made in the manufacture of Gas, either for Lighting or Heating purposes. With half a ton of Anthracite Coal 150,000 cubic feet of Gas per day is made from three benches, and the labor is so small that one man can attend three or four benches.

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CAPACITY 10,000 CUBIC FEET.

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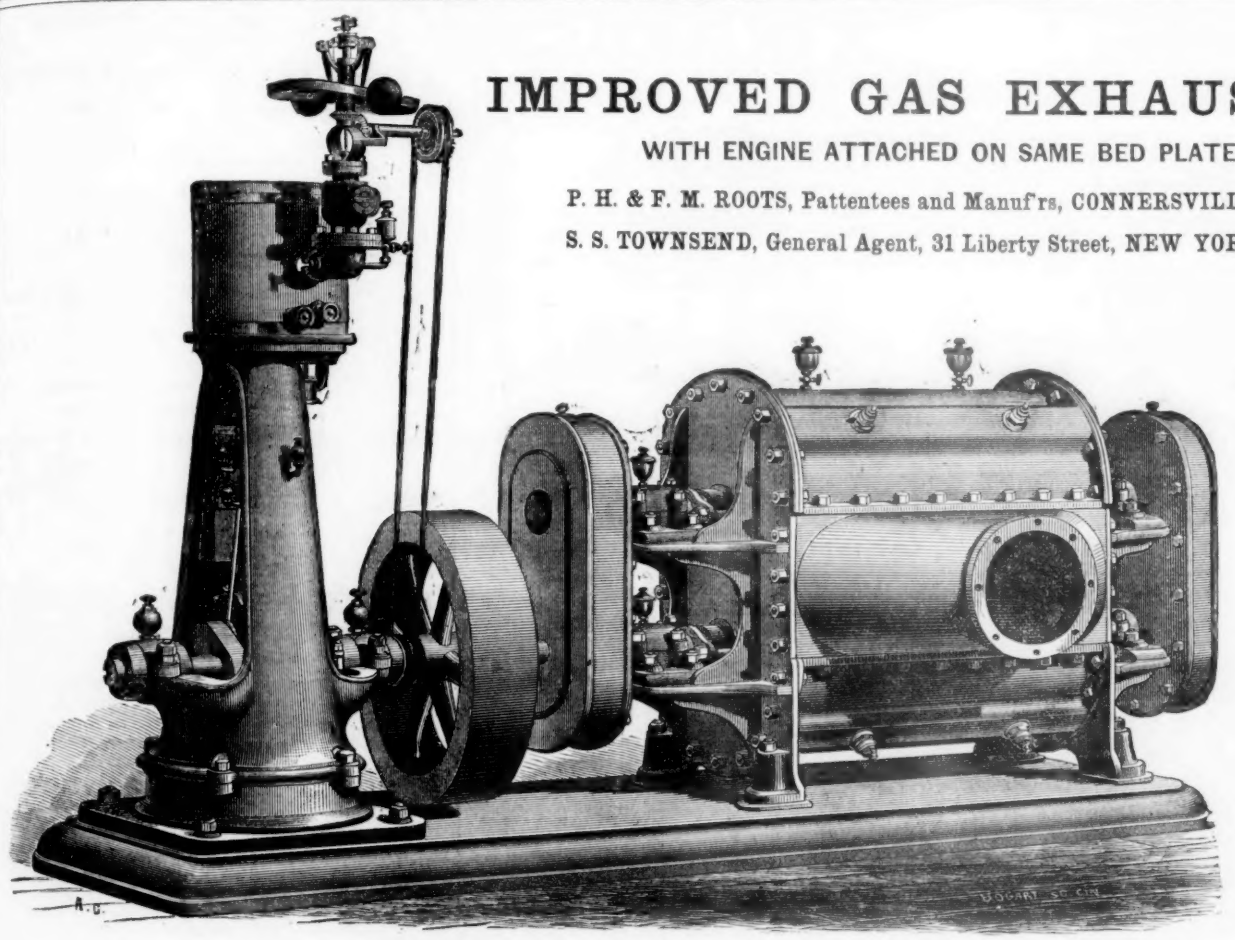

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It yields 10,996 cubic feet of gas to the ton of 2,240 lbs. of good illuminating power, and of remarkable purity; one bushel of lime purifying 6,792 cubic feet, with a large amount of coke of good quality.

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Best dry coals shipped from Locust Point, wharves, and prompt attention given to orders for chartering of vessels.

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To Gas Light Companies throughout the country.
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Mines in Harrison County, West Virginia.
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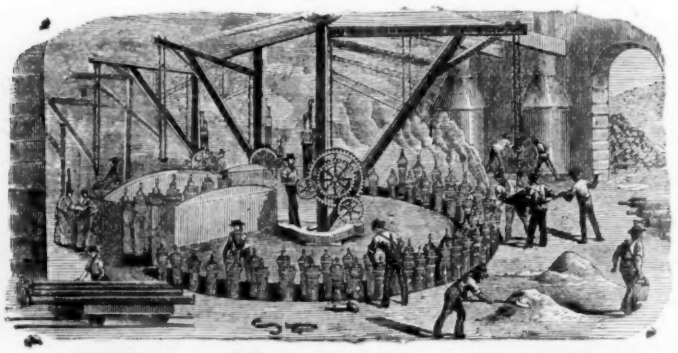

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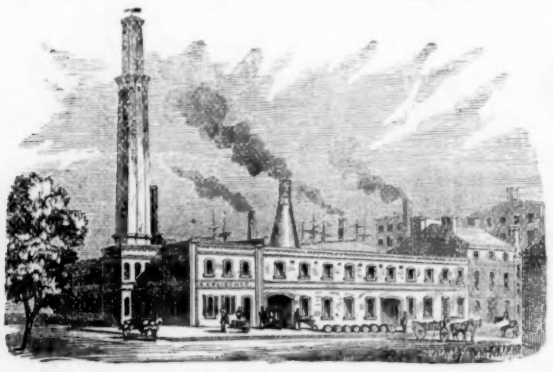

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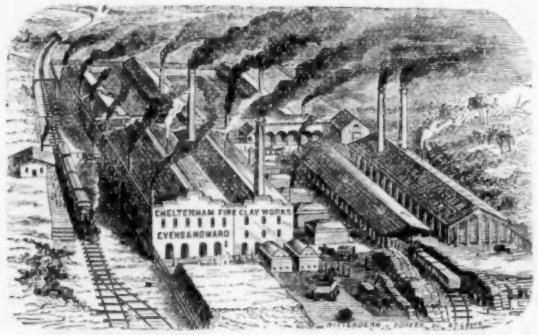

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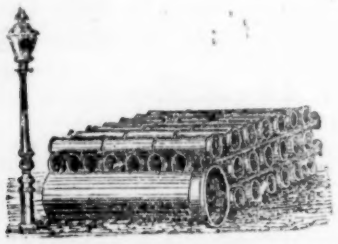

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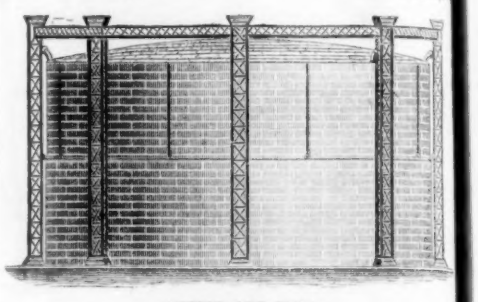

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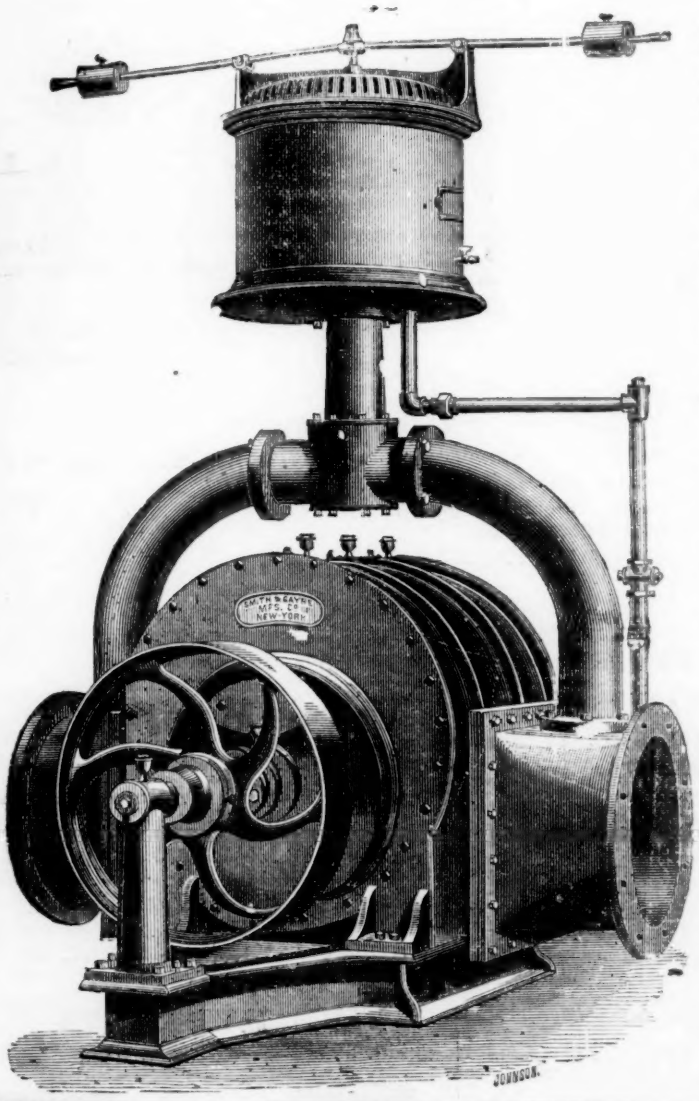

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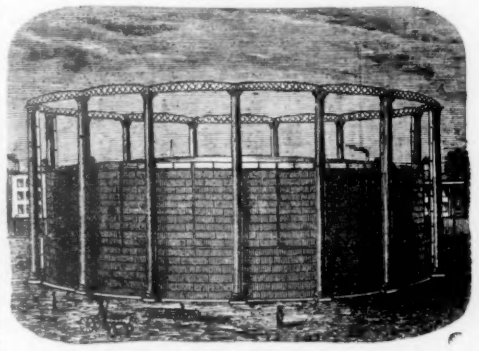

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Signed—A. T. GOSHORN, Director General

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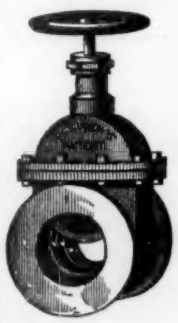

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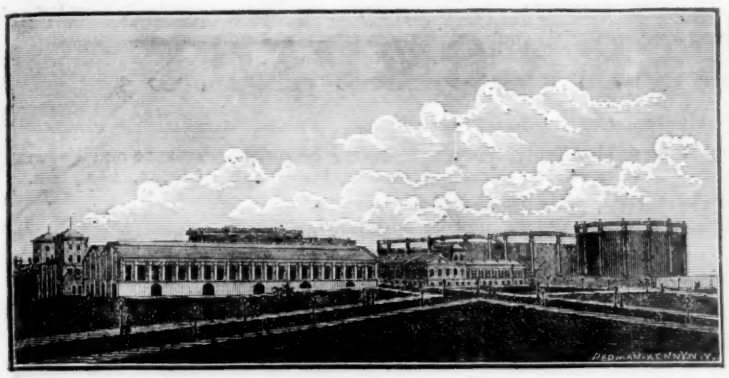

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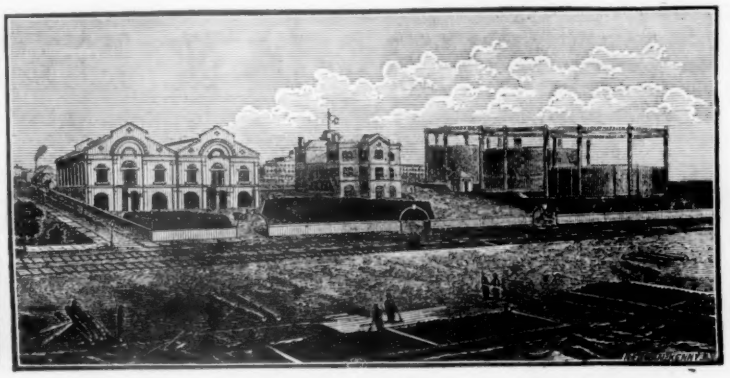

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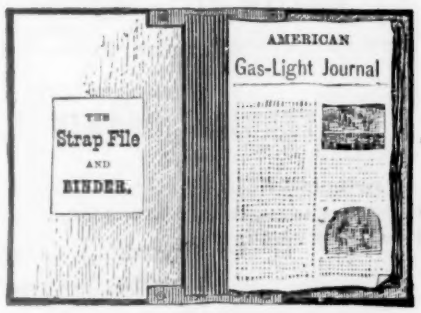

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